CMHC
Canada Mortgage
and Housing Corporation

SCHL
Société canadienne
d'hypothèques et de logement

GOOD PRACTICE FOR THE INSTALLATION OF WINDOWS, DOORS, AND SKYLIGHTS

Prepared for

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by

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Comments and suggestions are invited to further develop the material presented here and should be addressed to:

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Introduction

The purpose of this publication is to assist homeowners and builders to follow good practice in the installation of doors, windows and skylights in new and existing residential construction. The publication also discusses good practice for the repair and restoration of existing doors and windows.

Good practice is a mixture of tried and proven methods combined with new methods recently developed or adapted to meet the requirements of present-day wall, door and window construction and thermal efficiency.

Homeowners have these major complaints about windows and doors:

- condensation on the glazings
- hard-to-operate windows
- drafts around windows and doors
- a lack of confidence in the security provided by windows and doors becaus of thinner units and smaller hardware that do not seem to give as much protection as they used to.

By following the procedures outlined in this publication, the builder and the homeowner will reduce the likelihood of problems in the operation of doors and windows and, thus, costly future major repairs. Proper installation of doors and windows

will also help reduce air leakage and cut heating requirements. Twenty to fifty per cent of all air leakage in an average house is through and around windows and doors.

New windows, doors and skylights that are to be installed in buildings financed under the provisions of the National Housing Act must have a Canada Mortgage and Housing Corporation evaluation number, which means that the product has been tested to specific minimum CGSB and/or CSA standards.

WINDOWS, DOORS AND SKYLIGHTS

Windows, doors and skylights in residential buildings have several functions and are among the most important and expensive components of a building. If not properly selected and installed, their maintenance over the long term can be both costly and time consuming.

Doors must allow passage of persons and furniture, provide security, be thermally efficient and stop the penetration of rain.

Windows and skylights must allow adequate daylight into a building, provide ventilation, be secure against forced entry, be thermally efficient and stop the penetration of rain.

Doors, windows and skylights are also important architectural features of buildings.

Windows

Most windows in present-day new construction are preassembled in their frames at the factory and delivered to the construction site ready to be installed. Window units consist of many parts built to close tolerances. Figure 1 shows the parts of a window, figures 2 to 6 a variety of types of window.

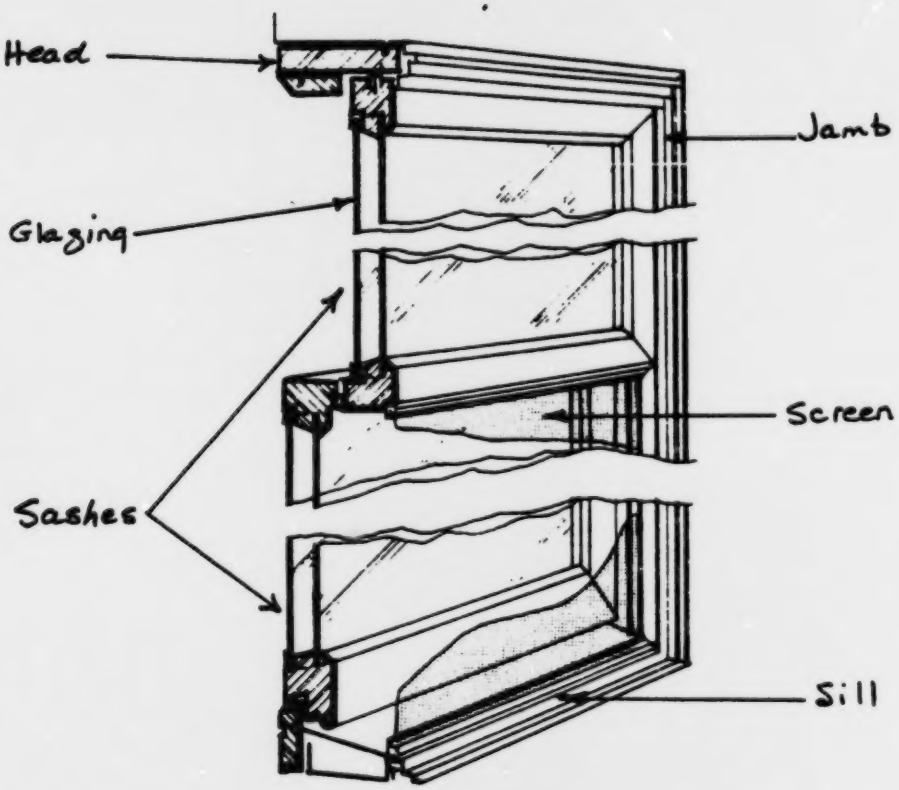


Figure 1 Three-dimensional view of a window

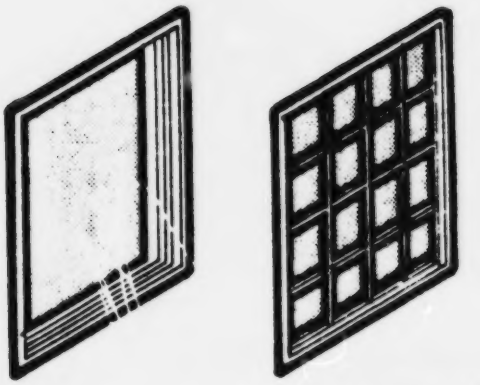


Figure 2 Fixed windows.

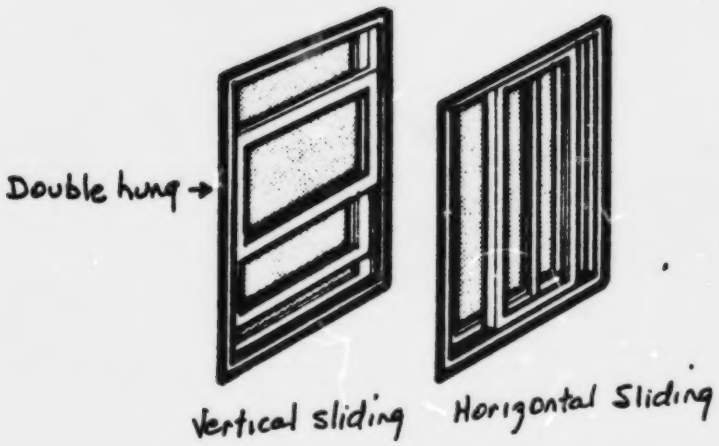


Figure 3 Sliding windows

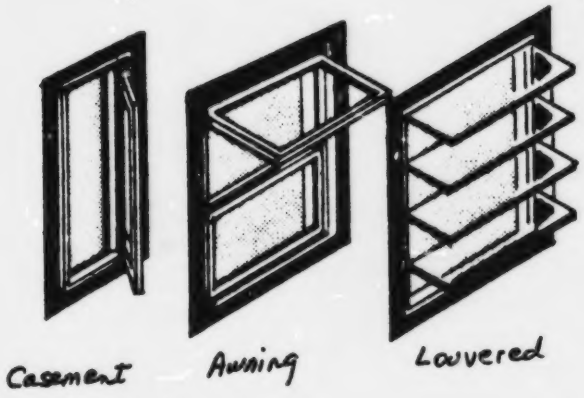


Figure 4 Hinged windows

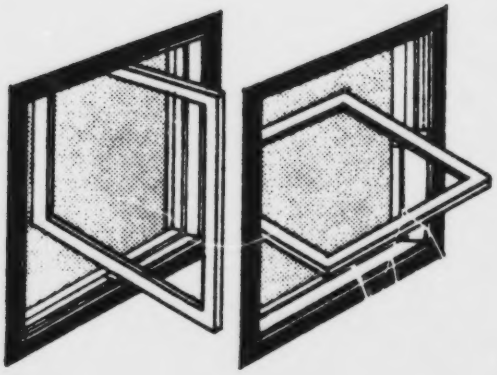


Figure 5 Pivoted windows.

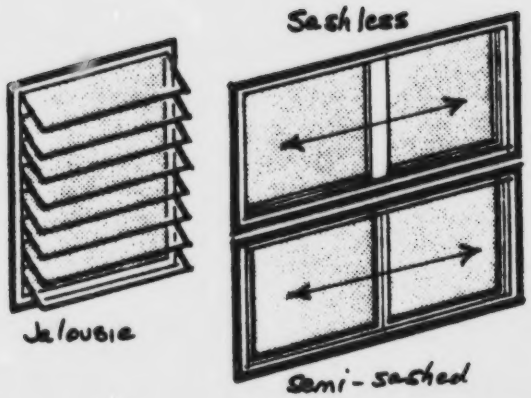


Figure 6 Jalousie and sashless windows

Entrance Doors

Entrance doors serve both as wall sections and as a means of access for persons and furniture. Entrance doors, while providing security against forced entry, must also allow for quick exit in emergency situations. In new construction, entrance doors are installed pre-hung. Figure 7 shows part of an entrance door and its frame.

Entrance doors are made of steel or wood. They have a solid core (usually wood) or an insulated core. Some may have glazing or wood panelling or both. The choice of an entrance door may depend on its cost. Sizes for entrance doors do not vary as much as they do for windows. There are two standard residential sizes:

810 x 2030 or 2130 mm (2' 8" x 6' 8" or 7')

910 x 2030 or 2130 mm (3' x 6' 8" or 7')

Various styles of entrance door units can be purchased locally or ordered from the factory. Figure 8 shows an entrance door with sidelights and transoms.

Sliding Patio Doors

Sliding patio doors are not main entrance doors but, rather, secondary entrances. They have become a common feature in today's housing. Patio doors give household occupants access to

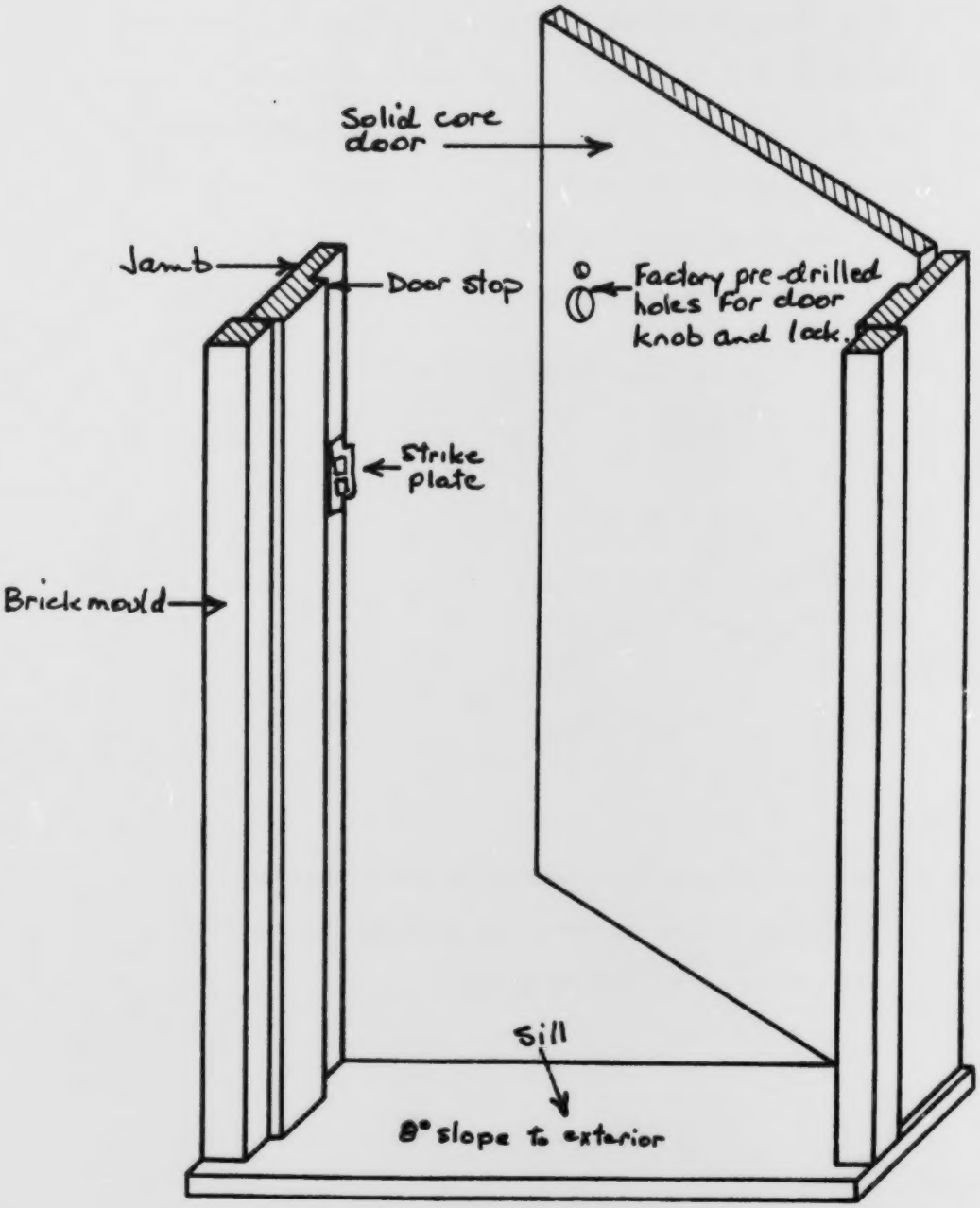


Figure 7 Part of an entrance door and its frame

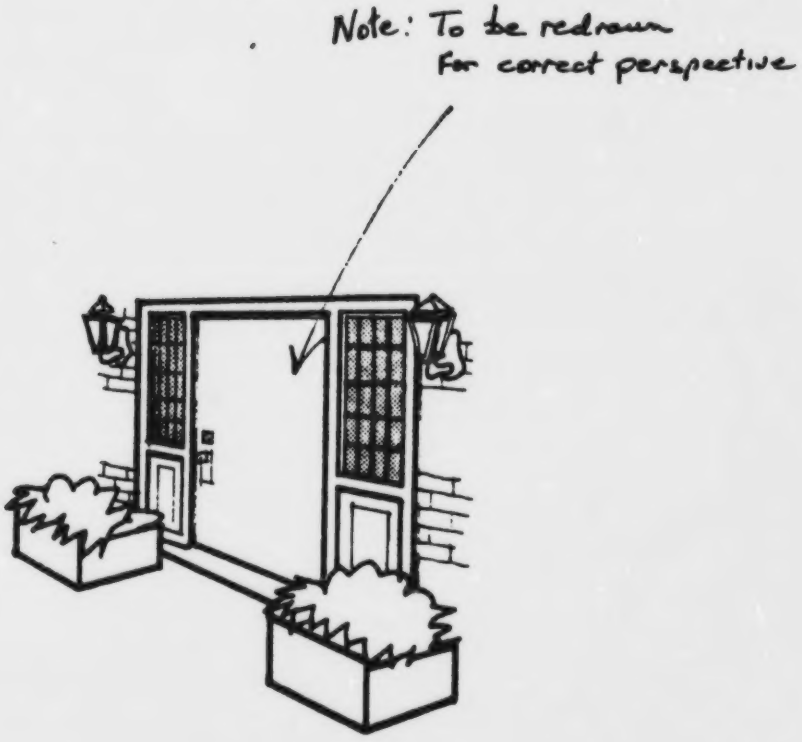


Figure 8 An entrance door with sidelights and transoms. Screening covers the sidelight glazing and protects the entrance from forced entry.

the patio, backyard or apartment verandah and provide excellent ventilation. These large glass areas are also a major source of heat loss and an inviting location for forced entry.

Sliding patio doors, which function as both doors and windows, have factory assembled frames. Sliding patio door units can be obtained in multiple door groupings. They are usually 2130 mm (7 ft.) in height and 1505 mm (5 ft.) in frame width. Figure 9 shows a typical sliding patio door and its parts.

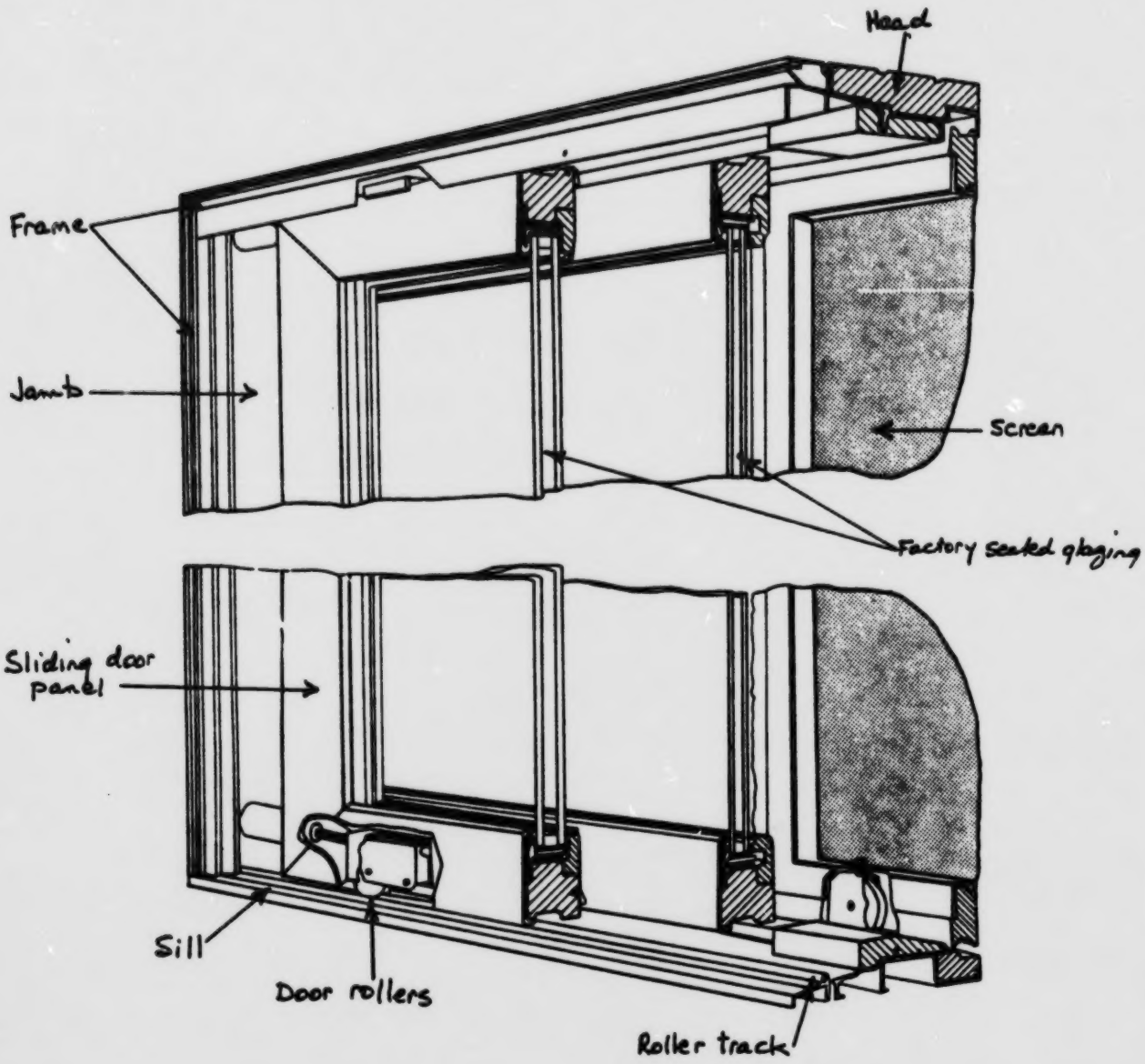


Figure 9 Three-dimensional view of a sliding patio door

THE INSTALLATION OF WINDOWS AND DOORS IN NEW BUILDINGS

The successful installation of windows and doors in new residential buildings requires a systematic series of steps. If followed, this will result in window and door assemblies that are easy-to-operate, energy- efficient and well secured. Several trades are involved in completing door and window assemblies, and the work of each will depend on the quality of the previous tradesman's work. Sliding patio doors are larger and heavier than other units and require more shimming and fastening. The installation of sliding patio doors requires considerable time and attention.

Care of windows and doors awaiting installation

Have doors and windows delivered to the site just prior to their installation. Leave window braces attached to their frames until the windows are ready to be installed. New doors should be delivered without door knobs and locks installed, but should be secured shut. Sliding patio doors must be well secured against moving within the frame. All door frames should be braced to maintain squareness and braces should remain on the doors until they are ready to be installed. Because of the size of their glass area, sliding patio doors are easily broken during construction. Put bright markings on the doors or

protect them with barricades. See Figure 10. Store doors and windows in rooms from which they can be easily retrieved and where they will not be damaged by other trades. Keep them dry. Any doors or windows that have defects that will affect their strength or durability should be rejected.

Rough opening for doors and windows

Check the rough opening. It should measure 25 to 40 mm (1 to 1½ in.) more than the window or door frame. This extra width and height is necessary to allow for shrinkage of the wood frame, squaring the frame and placing the insulation correctly. If the space is too large, use filler lumber to reduce it. Patio doors should overlap the outside face of the infill lumber by at least 6 mm (¼ in.) The brickmould should cover the rough opening space and rest against the exterior face of the wall sheathing. Clean the rough opening of any materials (nails, or wall sheathing) that might tear the sheathing paper that will be applied later. Wide entrance doors, doors with sidelights or transoms, and sliding patio doors may require lintels stronger than those used for standard doors. Figure 11 shows a window opening.

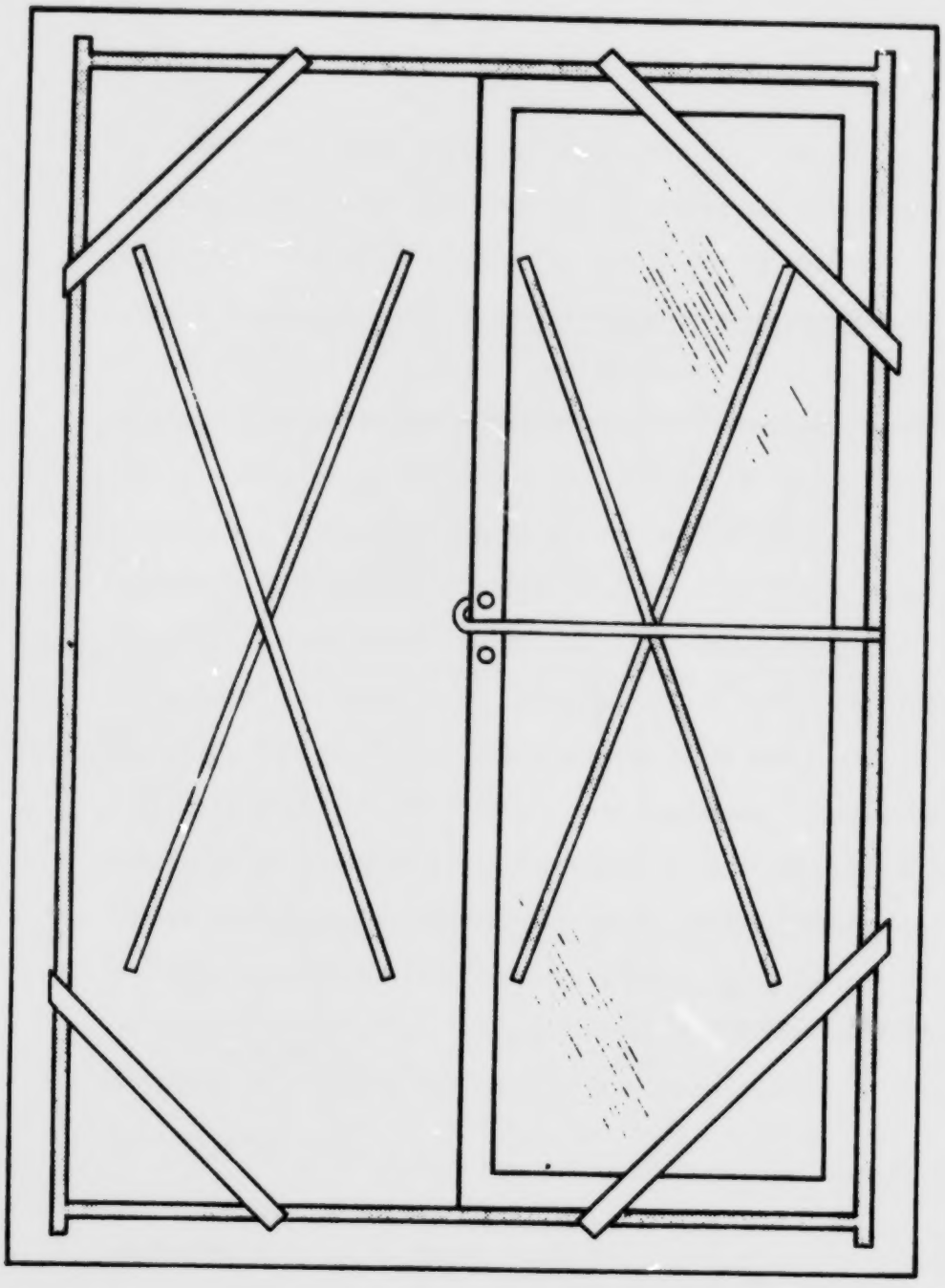


Figure 10 Braces keep the sliding door frame square until it is ready to be installed. Strapping prevents doors from sliding and breaking. Bright markings (paint or fluorescent tape) on the glass will make it more visible and less vulnerable to accidental breakage.

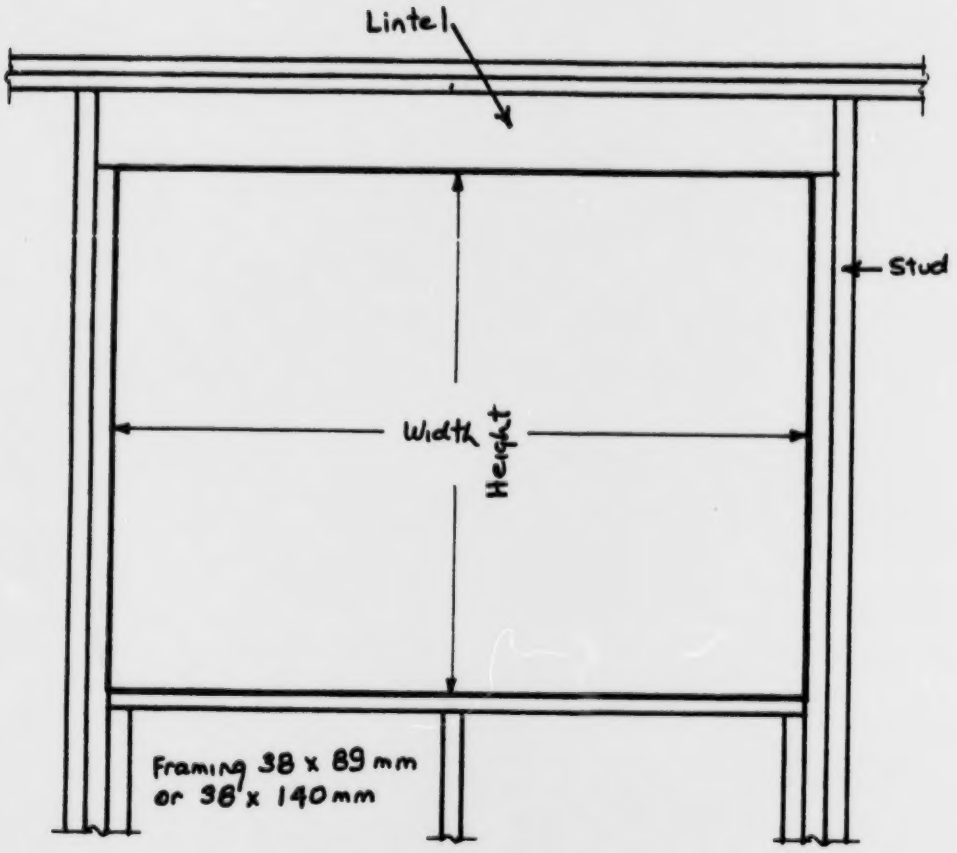


Figure 11 Typical wall framing at a rough window opening. The depth of the wood lintels are determined by their span and the building characteristics.

Fold and staple sheathing paper over all sides of the rough opening. This keeps the frame dry by preventing moisture in the wall frame from reaching it. Figures 12 and 13 show how sheathing paper is applied to window and door frames.

To accommodate various levels of insulation, new buildings are built to differing wall thicknesses. Window and door frames are manufactured in 120 mm (4 5/8 in.) and 170 mm (6 5/8 in.) thicknesses. They can also be ordered with an adjusted thickness to suit any wall construction. This added thickness is called a jamb extension. If possible, avoid windows and doors with jamb extensions. Order them with full side jambs. The crack left where the jamb extension joins the frame is just another place where air may seep into the house. Thicker walls are becoming standard in the industry, so wider window and door frames should become commonly available. See figure 14 for the positioning of windows, doors, and sliding patio doors in walls of various thicknesses. Figures 15 and 16 show the placement of a window in a masonry wall and a suite entrance door in a metal studded wall.

Fastening windows and doors to walls in wood frame construction

Windows, doors and sliding patio doors should be installed by two persons, one to do the levelling and checking and hold the unit firmly in place, and the other to do the fastening. Many

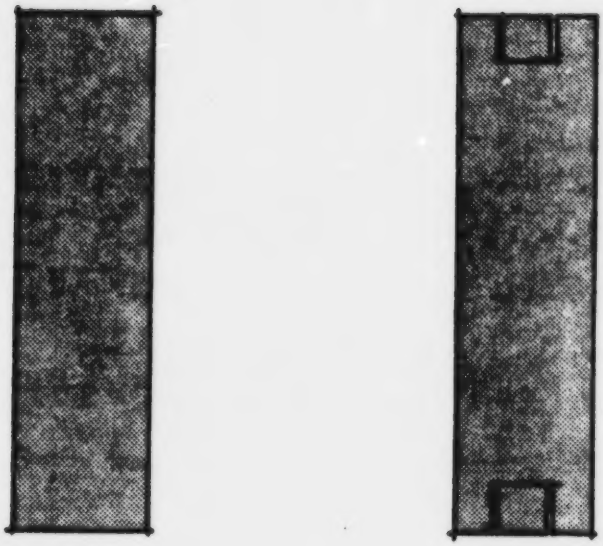


Figure 12 Cut sheathing paper 150 mm (6 in.) longer than the side of the rough opening it is to cover. Make cuts at both ends 75 mm (3 in.) long, as shown. The width of the middle strip should be the same as the width of the framing stud. Contrary to common practice, the sheathing paper should extend into the corners to protect the window frame against moisture.

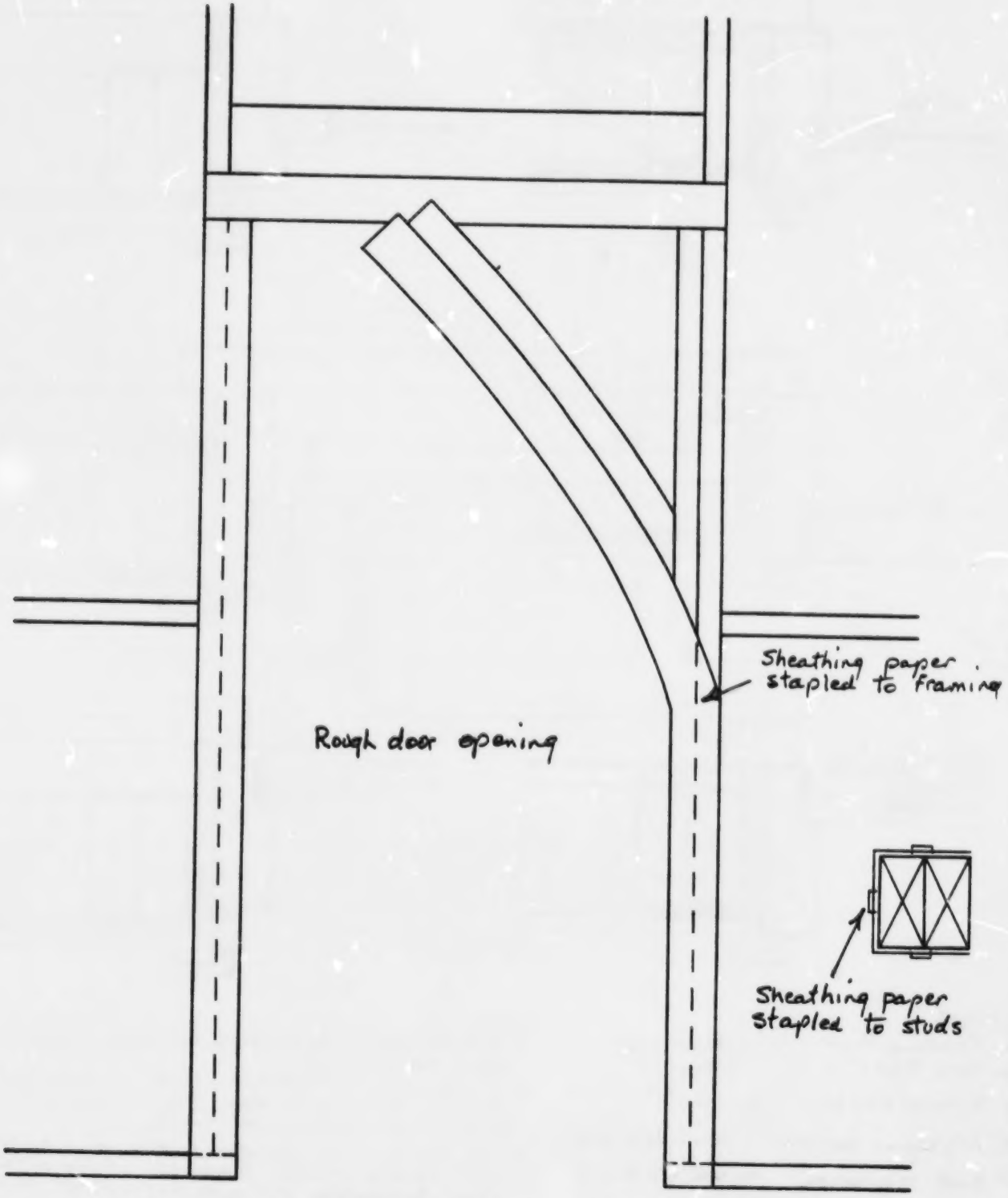
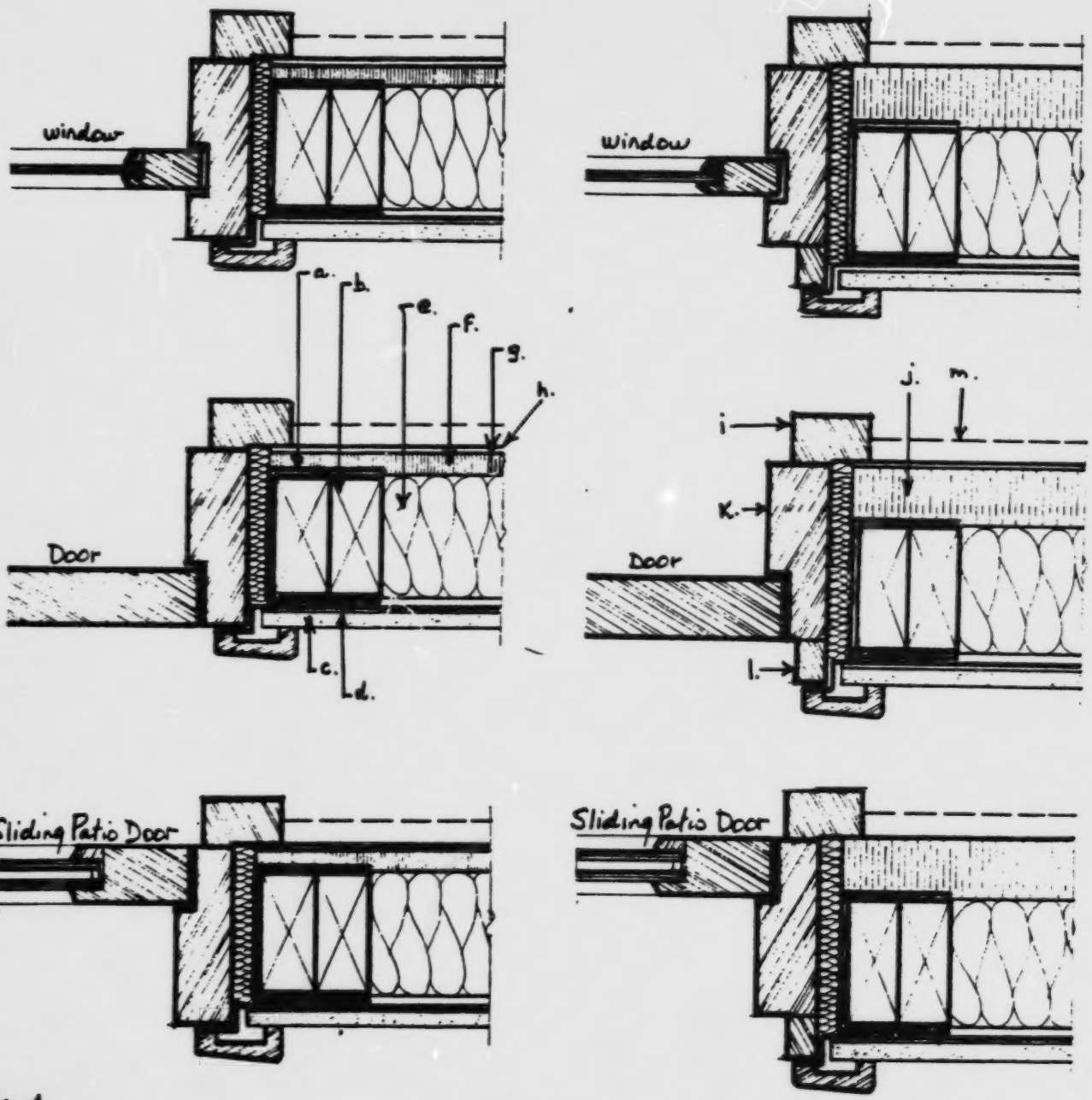


Figure 13 Sheathing paper keeps the back side of the door frame dry by preventing moisture from the wall frame from reaching it

Figure 14. Placement of a window, entrance door or sliding patio door in a 38 x 89 or 38 x 140 mm wall with or without exterior rigid insulation.



Legend

a. Sheathing Paper
b. Wall Studs
c. Gypsum wall board
d. Air/vapour barrier
e. Batt Insulation
f. Exterior wall sheathing
g. Sheathing paper
h. Exterior siding[1]
i. Brickmould tight against exterior sheathing
j. Exterior rigid insulation.
k. Jamb[2]
l. Jamb extension[3].
m. wall cladding

Notes

1. Exterior siding to be installed after windows and doors are in place.
2. If there is no exterior sheathing material, position window or door frame flush with the drywall or interior wall finish.
3. The length of the window or door jamb extension will depend on the thickness of the exterior rigid insulation. It should extend out to be flush with the interior wall finish. Fasten the frame in place through the side jambs. If no jamb casing is used, turn the interior wall finish around the corner and finish at the jamb. A moulding may be added here to hide the crack that often develops between the interior wall finish and the frame.

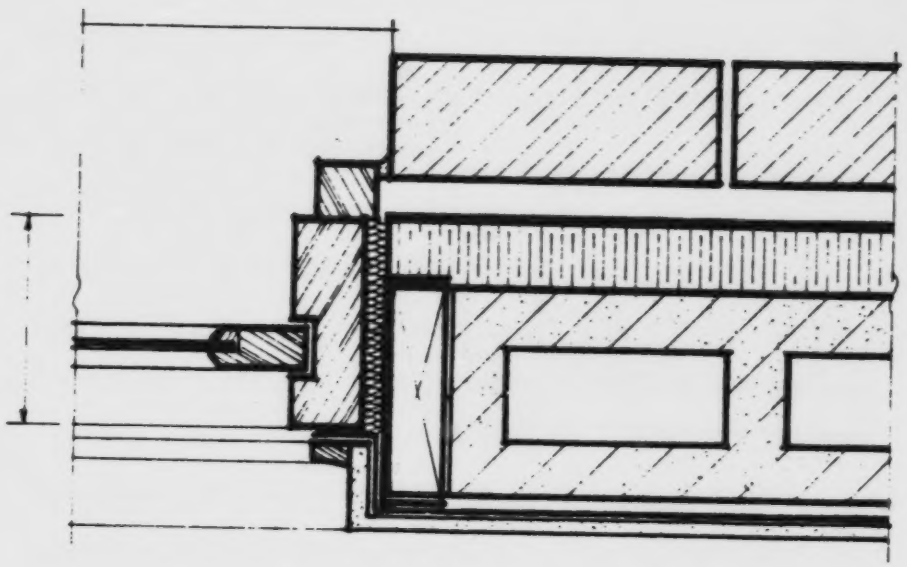


Figure 15 Placement of window in a masonry block wall.

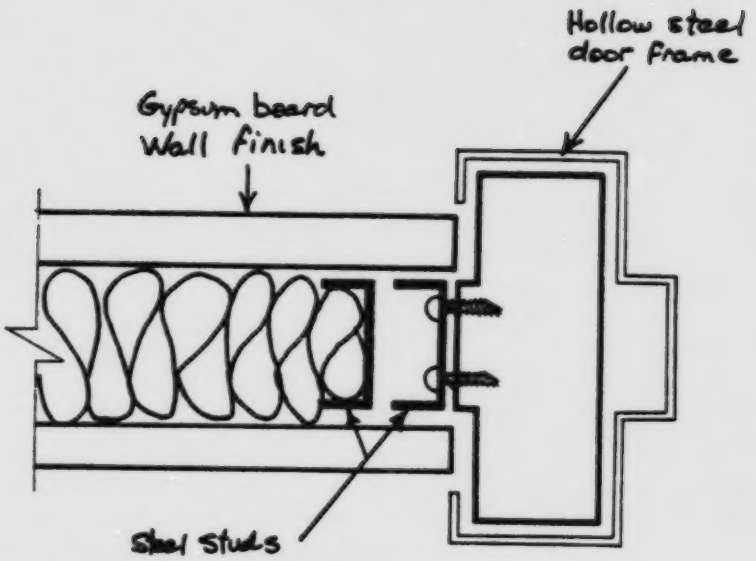


Figure 16 Placement of a window, suite entrance door or sliding patio door in a metal studded wall.

windows and doors are heavy and require two persons to lift into place and position. Frames should be fastened to the rough framing with screws or finishing nails. Use 90 mm (3½ in.) screws or finishing nails. On aluminum windows, use aluminum or stainless steel screws. On steel windows, use galvanized steel screws. Make sure that half the length of these fasteners penetrates the wall framing. When using screws, pre-drill the holes to about 60 per cent of the screw's shank diameter and to the full depth of the screw.

A pre-hung entrance door and sliding patio doors should remain in their frames during installation, to keep the frames square. Slide patio doors back and forth in their frames during installation; this also helps keep the frame square.

The shims required for installation should be pre-cut. Cedar shingle shims can be purchased from most building material suppliers. This eliminates the often unsatisfactory fabrication of shims from scrap material on-site.

Many wood windows have jambs that extend down approximately 25 mm (1 in.) lower than the sill. These small extensions on each side of the sill used to be cut down the necessary amount to level the sill, but this installation procedure is not common any more. Shims are now placed beneath these legs to level the sill. The space provided by the window jamb continuation ensures that the sill is not sitting on the rough framing, and leaves an opening large enough for placing the insulation.

Place the door or window assembly in the rough opening and centre it. Position it within the wall so that the interior jambs will be flush with the interior finishing. Level the sill. For doors, plumb the strike jamb (as opposed the the hinge jamb) with a 1200 mm (4 ft.) carpenter's level placed on the inside of the jamb. Shim between the jamb and the rough opening 300 mm (12 in.) down from the header. For windows, place a shim 150 mm (6 in.) up from the bottom of the window frame. Fasten the jamb through the shim into the wall stud. Fasteners should not be driven through any exterior parts of the frame, expecially the sill, as rain may seep in through the openings made by the fasteners and cause rot. Do not drive the heads of the fasteners tight in until the frame is completely shimmed. See figures 17 to 19.

Entrance doors with double doors, sidelights or transoms have larger frames and require more fastening. Shim and fasten every 500 mm (24 in.) along the sides. Shim and fasten the head and sill at joining mullion.

Door chimes or buzzers are usually placed on the exterior door jambs. The wiring that operates these chimes must be hidden before the finishing work is done. Drill through the face of the brickmould into the space behind the door jamb and insert the wiring.

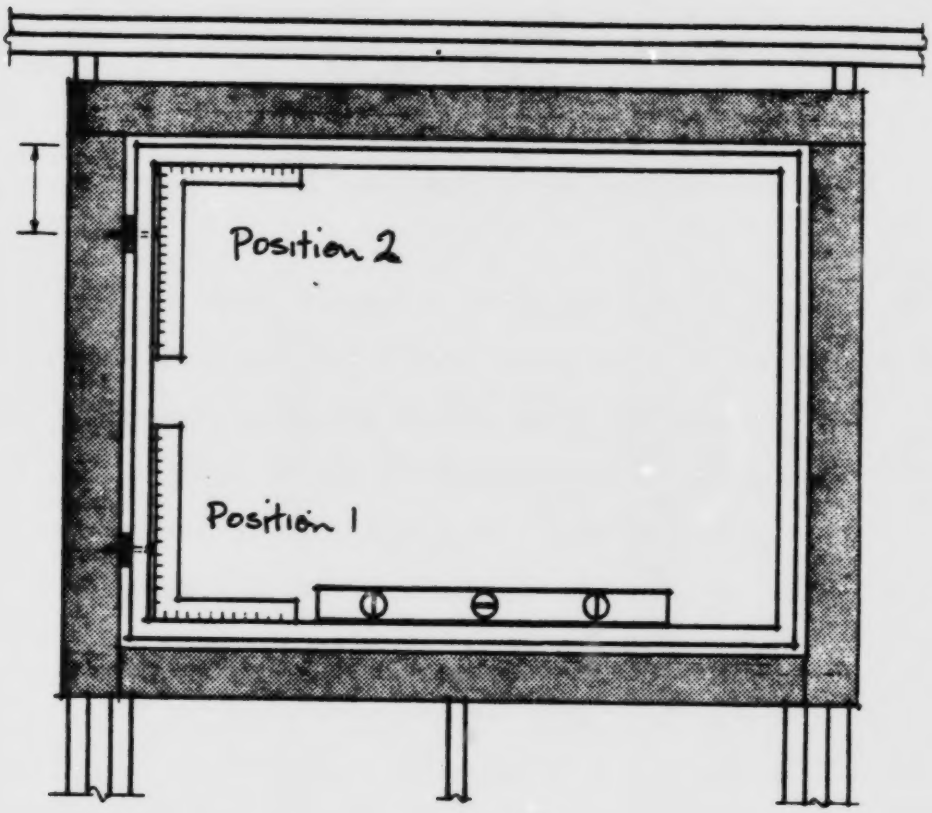


Figure 17

Figure 17 Level the sill. Place a square in position 1, as shown, and square the side jamb. The front face of the jamb should be flush with the finished drywall, which will be applied later. Place the square in position 2 and square up the frame head. Fasten the frame through a second shim placed 150 mm (6 in.) down from the top of the window frame.

All corners should now be square. Check the other jamb by placing the square in position 3 and then in position 4. If the corners are square, fasten the window. Try opening and closing the sashes of operable windows. If no adjustment is necessary and if sashes do not require more than 45 N (10 lbs.) force to open or close, drive all fasteners in permanently. Fill the countersunk heads of the fasteners with an appropriate compound.

NOTE: On larger units fasten through shims at 600 mm (24 in.) spacings. Shim and fasten also through sill. Drive all fasteners through shims. Be careful not to damage the jamb extension, if any, when shimming the window frame.

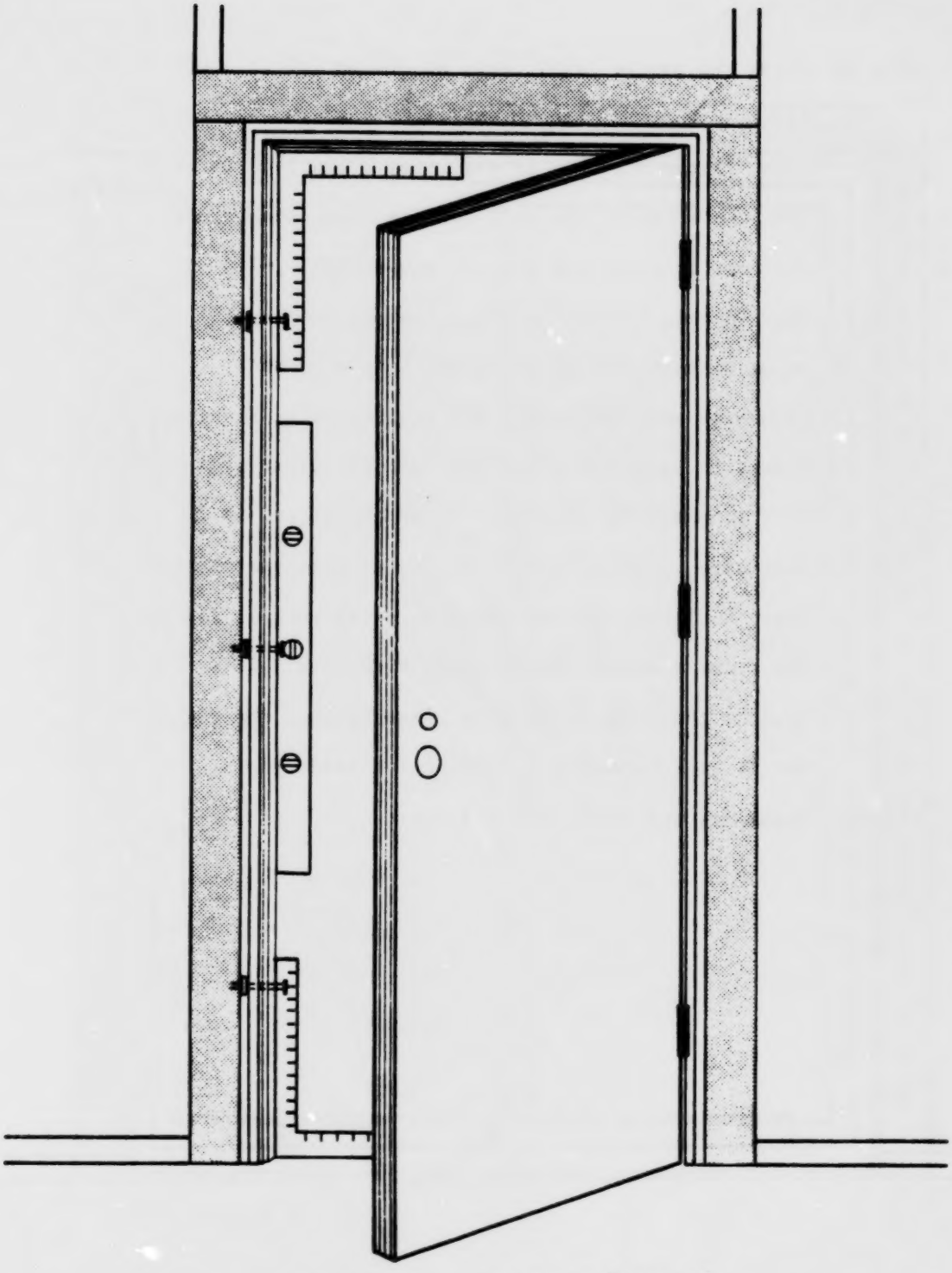


Figure 18. Detail on following page.

Figure 18 Plumb the strike jamb. Shim at 300 mm (12 in.) up from the bottom. Fasten the frame through this shim. Place a square in positions 1 and 2 to check the squareness of the sill and the head, then close the door to check for overall squareness. With the door opened, fasten the hinge jamb by wedging in shims beneath each of the three hinges. Check plumbness with the level, and squareness by placing square in positions 3 and 4. Open and close ;the door to check for binding. If no adjustment is necessary, place a shim in snugly beneath the strike plate and drive all fasteners in permanently. Fasten the frame a second time through each shim. This secures the frame solidly in place against the rugged use it will encounter. Countersink heads of fasteners and cover with a filler.

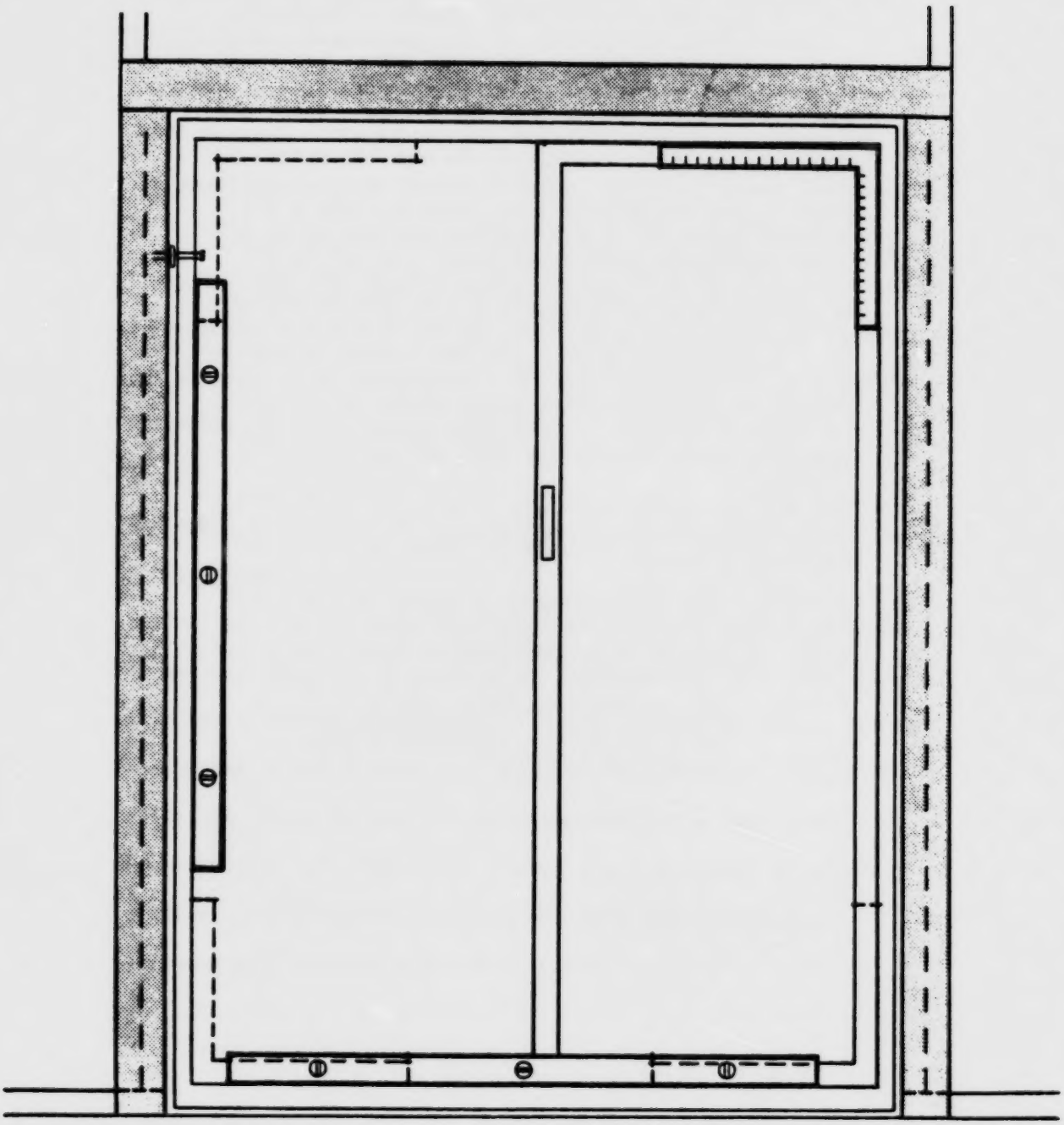


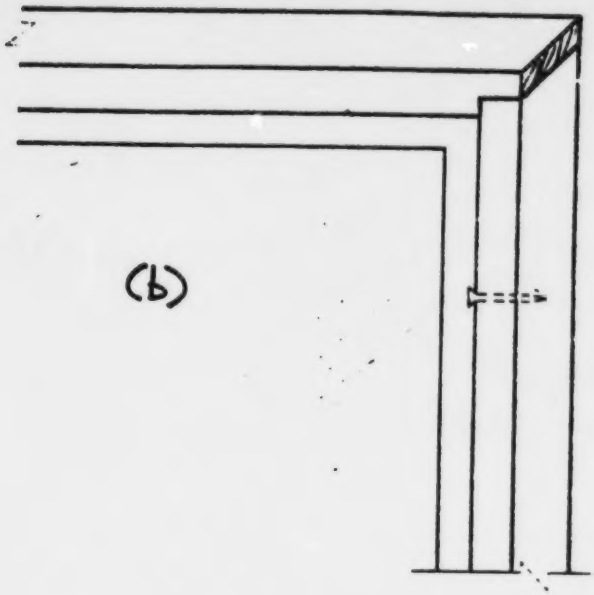
Figure 19.

Figure 19 Plumb the strike jamb. Adjust by wedging in shims 300 mm (12 in.) up from the bottom. Fasten the frame through this shim. Place a square in position 1 and then in position 2 to check squareness. Fasten the other side jamb by wedging in shims 300 mm (12 in.) down from the top and up from the bottom. Check the jamb with the level and fasten through the shims. Place square in position 3 and then position 4 and check squareness. Slide the doors back and forth. If no adjustment is necessary and if door panels do not require more than 45 N (10 lbs.) force to open or close them, place two more shims behind each side jamb, two shims beneath the sill and one shim over the header. Place the shims snugly and check with the level. During the shimming process, slide the doors back and forth to help in adjusting the frame. Drive all fasteners in completely. Fasten the frame a second time through each shim. countersink the heads of all fasteners and cover with a filler.

In winter, sliding patio doors have to be installed quickly to prevent heat loss in the new building. They are frequently held in place temporarily, to be shimmed and permanently fastened later. The sliding patio door may be fastened with double-headed nails driven through the brickmould. These nails are available in some hardware stores. Another method consists of driving nails into the backs of the jamb. These nails are bent down onto the rough framing studs. This squeezes the frame between the brickmould and the interior placed nails. Take care not to damage the brickmould, the jambs or their extensions when fastening the patio doors temporarily. See figure 20.

Fastening entrance doors and windows to the wall in masonry construction

Masonry wall construction may be solid or cavity wall with brick or masonry veneer on the exterior. Installation will vary to suit the construction material. In poured concrete walls, set a wood frame in the framework. This becomes the rough framing to which the window or door is later fastened as in wood frame construction. Alternatively, fasten steel subframes or steel studding to the concrete opening and later place a metal entrance door or window assembly in it.



(a)

Figure 20 Double-headed nails[a] are used for temporary fastening because their second head makes them easier to remove. Fasten sliding patio door temporarily into position from the interior of the building by driving nails into the back side of its jambs.[b]

Doors

In a concrete block wall, position the steel door frame in the entranceway and build the block wall around it. Set masonry anchors, wedged into the back of the door frame, into the mortar joints as the wall is raised around the door frame. If exterior entrance door frames are exposed to rain, caulk the steel frames to the concrete blocks with a non-setting sealant. See figures 21 and 22.

Suite entrance doors are often placed in steel studded walls. To fasten a hollow steel door frame in a steel studded wall, wedge steel stud anchor plates in the back of the door frame. Position the suite entrance door and then fasten through the steel stud into the anchor plate with drywall screws. Double the steel stud frame to strengthen the assembly. Suite entrance door assemblies that border concrete openings may not have enough space to double the steel studs. To strengthen door assemblies in concrete openings, fasten to the concrete floor. See figures 23 and 16.

Windows

When metal subframes for windows are installed as wall construction proceeds, they are held in place by a variety of clamps or lugs. The fasteners are attached to the back of the

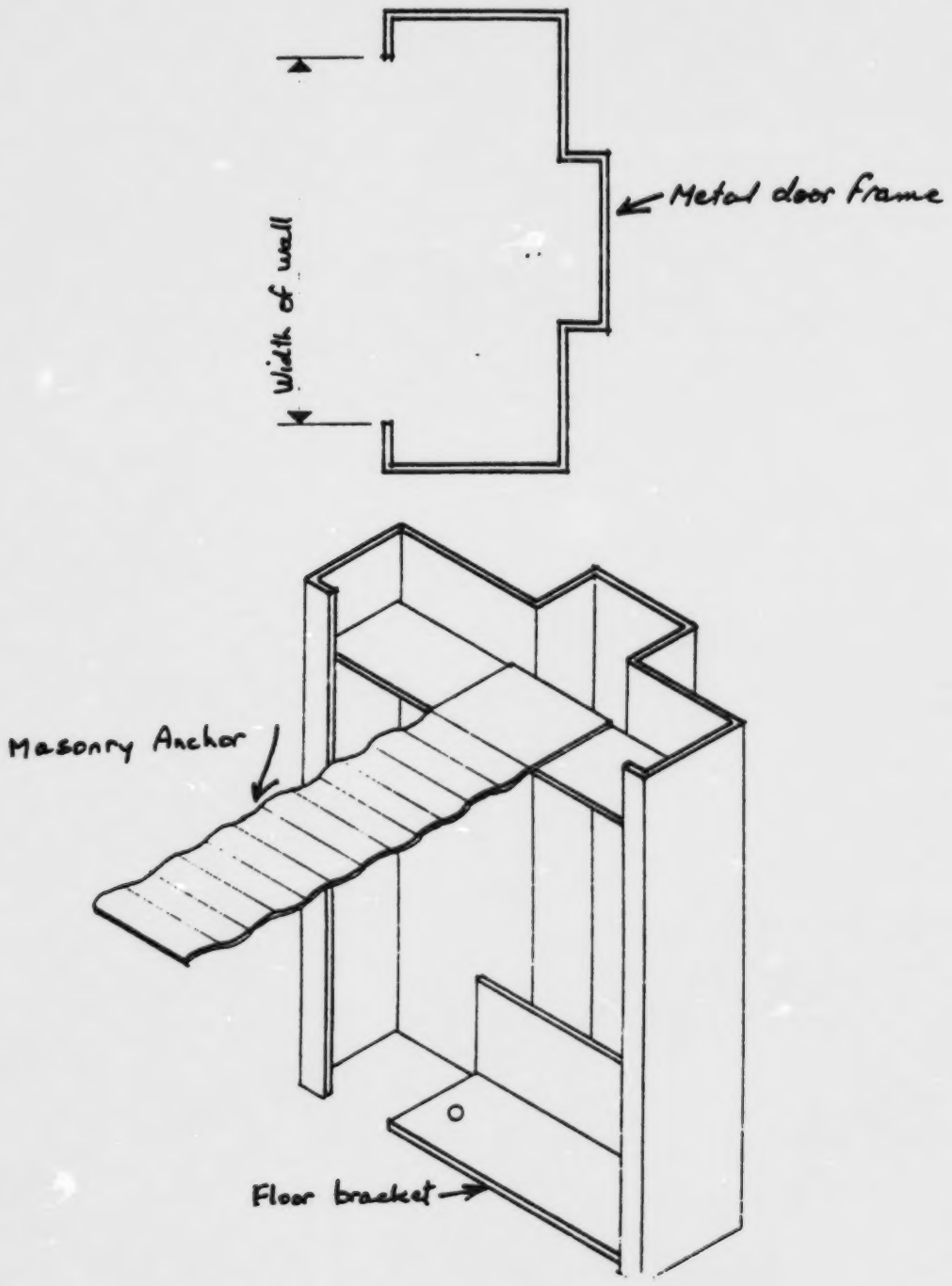
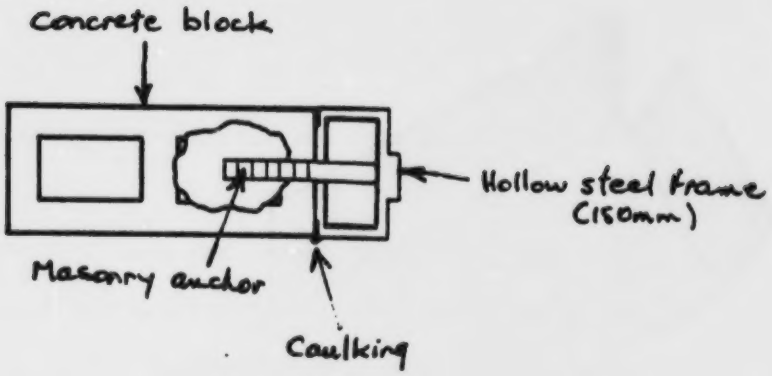


Figure 21 Hollow metal door frame and masonry anchor.



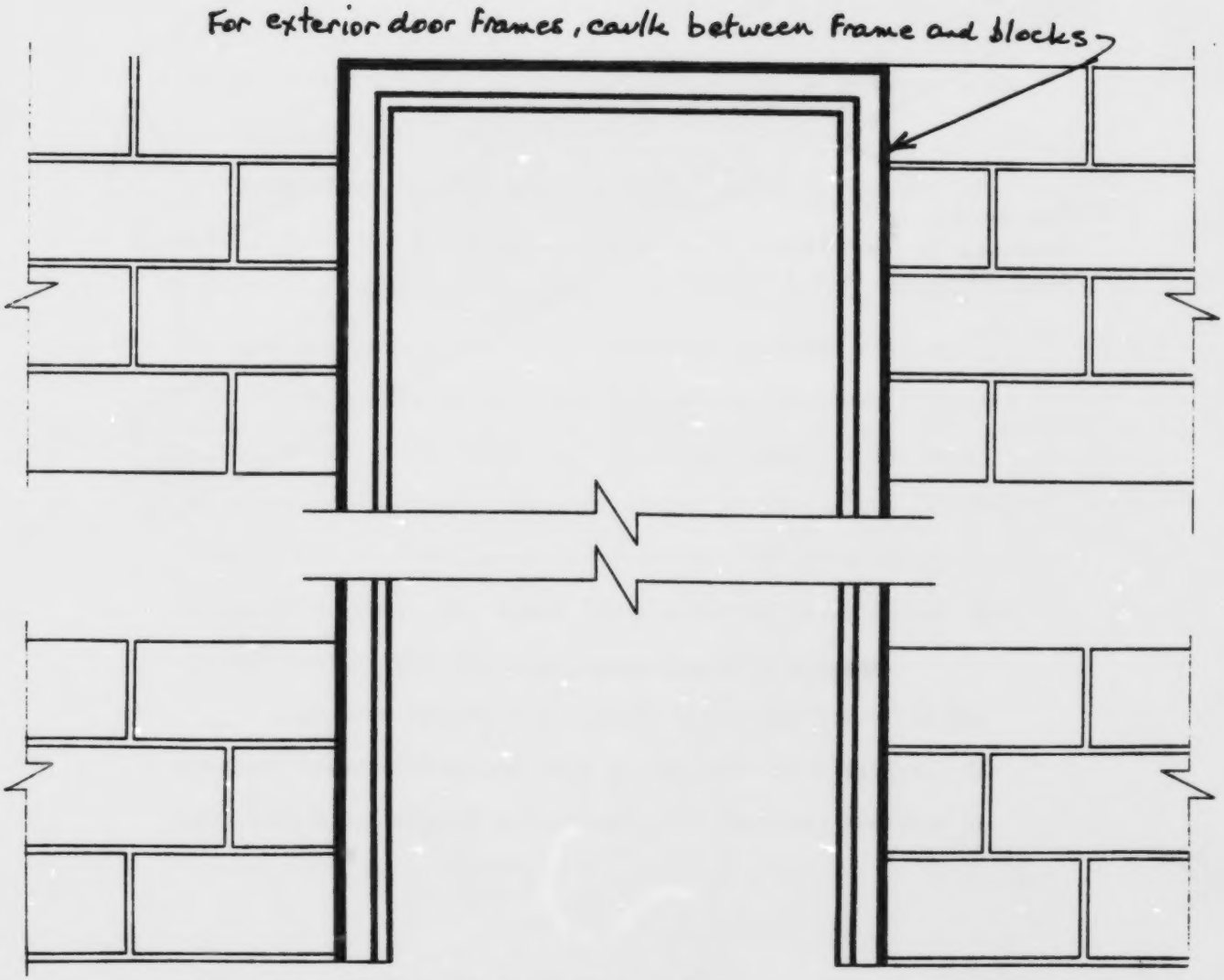


Figure 22 Hollow steel entrance door frame fastened to a concrete block wall

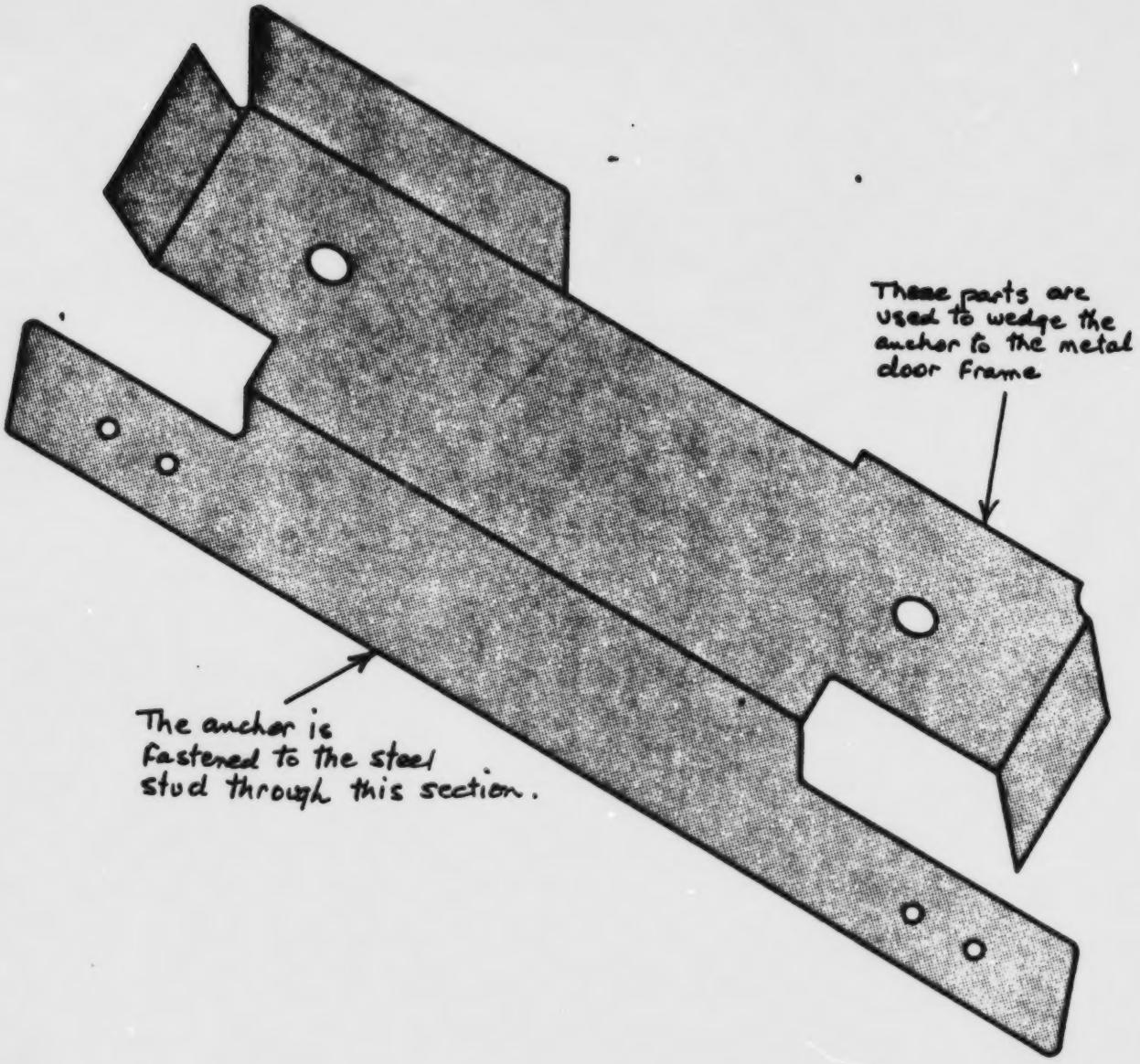

These parts are used to wedge the anchor to the metal door frame
The anchor is fastened to the steel stud through this section.

Figure 23 Steel stud anchor.

subframe and anchored into the mortar bed joints. See figures 24 and 25.

When the window subframes are installed in preformed masonry openings, they are usually fastened to the masonry with an impact gun. This device delivers a nail-like fastener with an explosive force that drives the fastener into the masonry. The fasteners are aimed so that they penetrate the mortar joints. These joints should be reinforced first; do this by filling the hollow block cavity with cement. The window assembly is then installed inside the subframe as it would be in a wood-framed wall. See figure 26.

Because of the high humidity levels common to masonry construction, the wood subframes should be treated with preservative. A 10 mm (3/8 in.) space should be left between the subframe and the masonry for exterior caulking. Mortar pointing should not be used here because the long-term expansion of the masonry or brickwork will eventually cause it to crack and allow rain to enter. When brickwork is used as the exterior finish, caulk between the window frame and the brick finish (Figure 27). Where the window frame meets the brick finish, use caulking rather than pointing; caulking will not crack.

In high-rise residential construction, exterior walls are sometimes steel studded and have an exterior brick finish. In this case, steel windows are fastened to the steel studding by

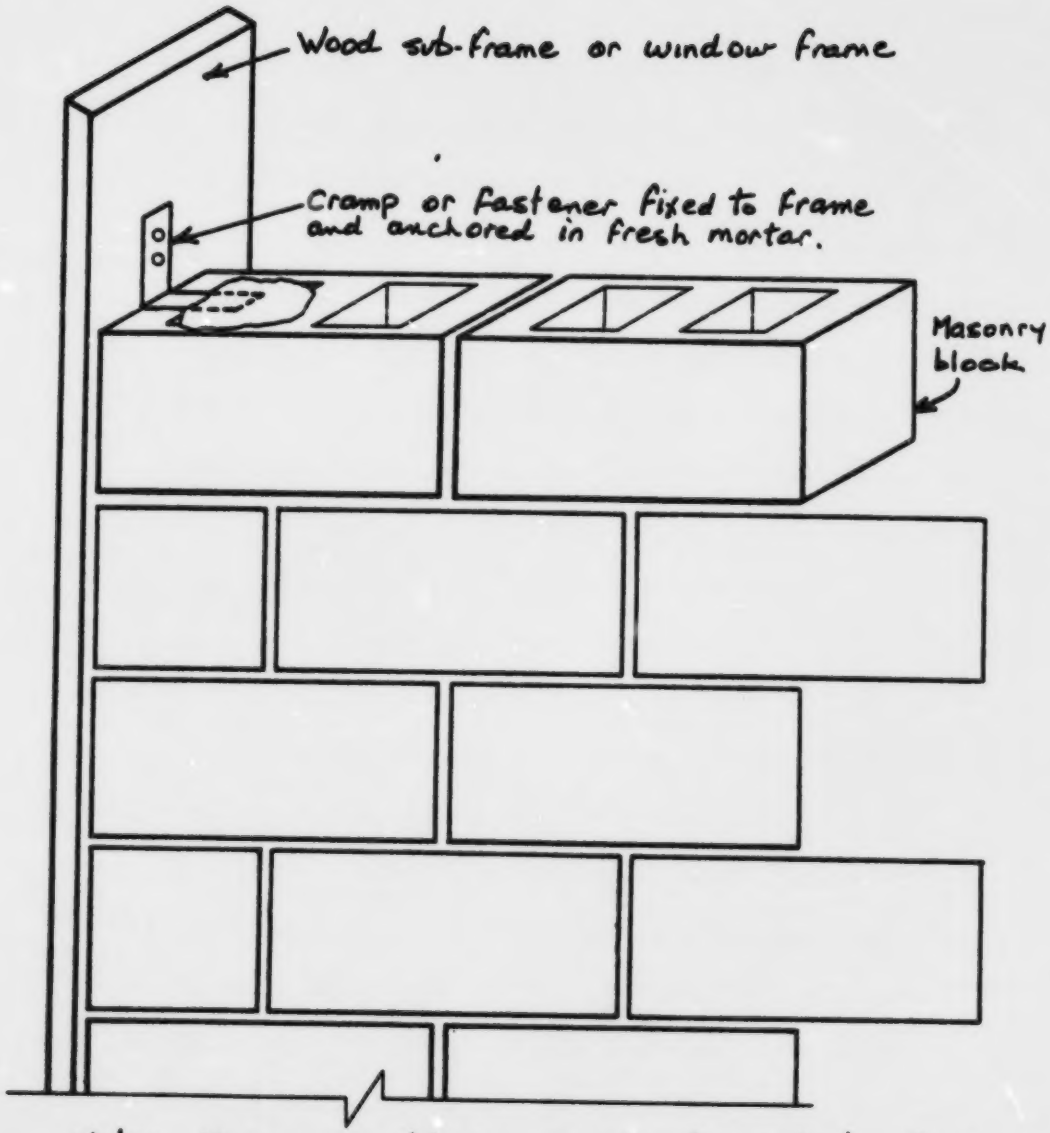

Wood sub-frame or window frame
Cramp or fastener fixed to frame and anchored in fresh mortar.
Masonry block
Note: If concrete blocks are also the exterior finish, leave 8mm (⅜ in.) for caulking.

Figure 24 Cramp used to fasten wood subframe or wood window to a masonry block opening.

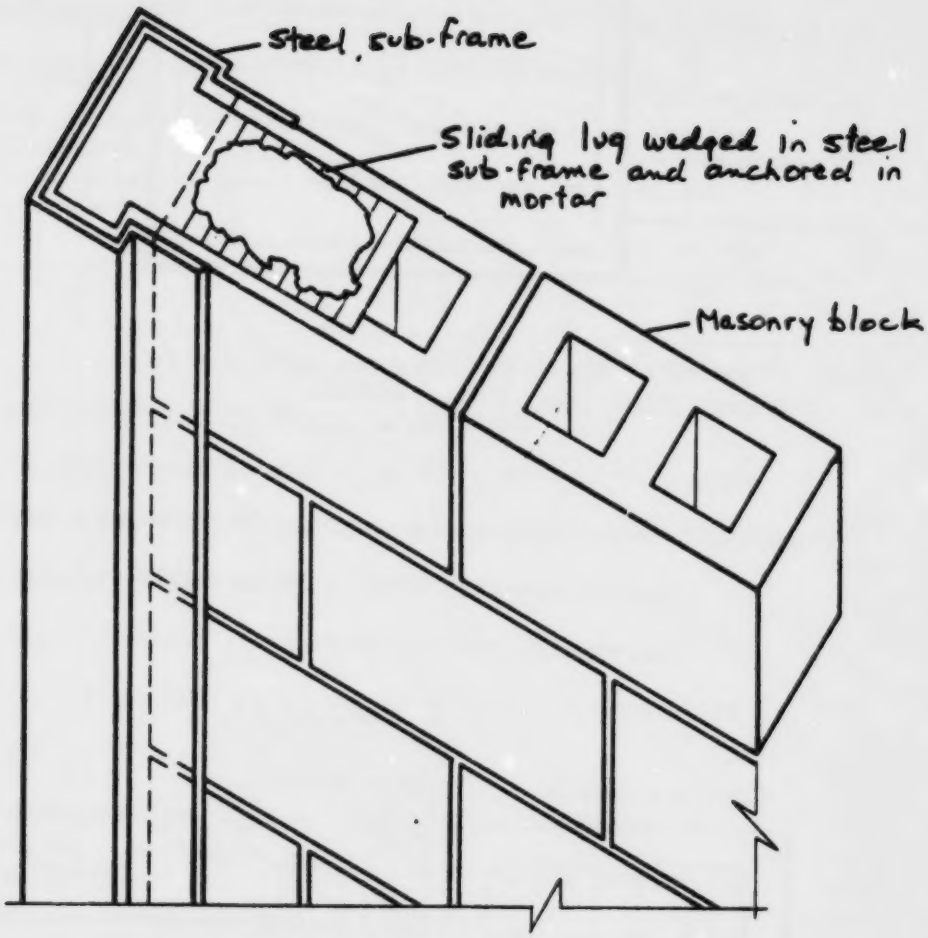


Figure 25 Lug used to fasten steel subframe to a masonry block opening.

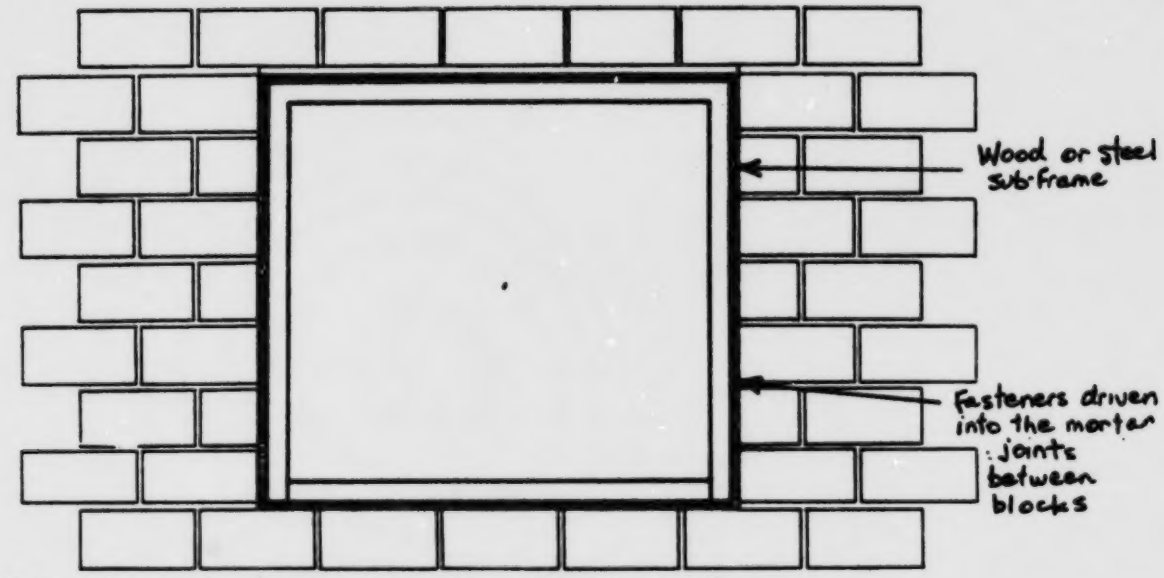

Wood or steel sub-frame
Fasteners driven into the mortar joints between blocks
Note: If concrete blocks are also the exterior finish, leave 10mm (3/8 in.) for caulking.

Figure 26 A wood subframe fastened to the sides of a preformed masonry opening. The window assembly is later fastened to the subframe.

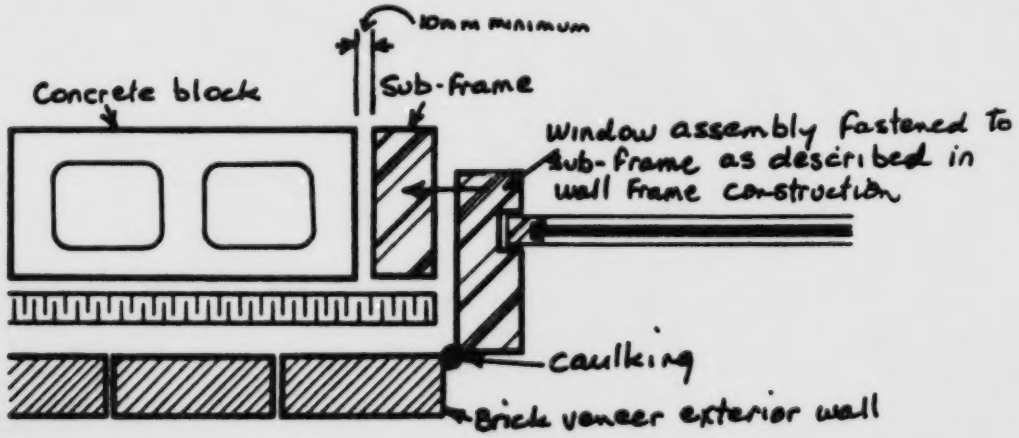


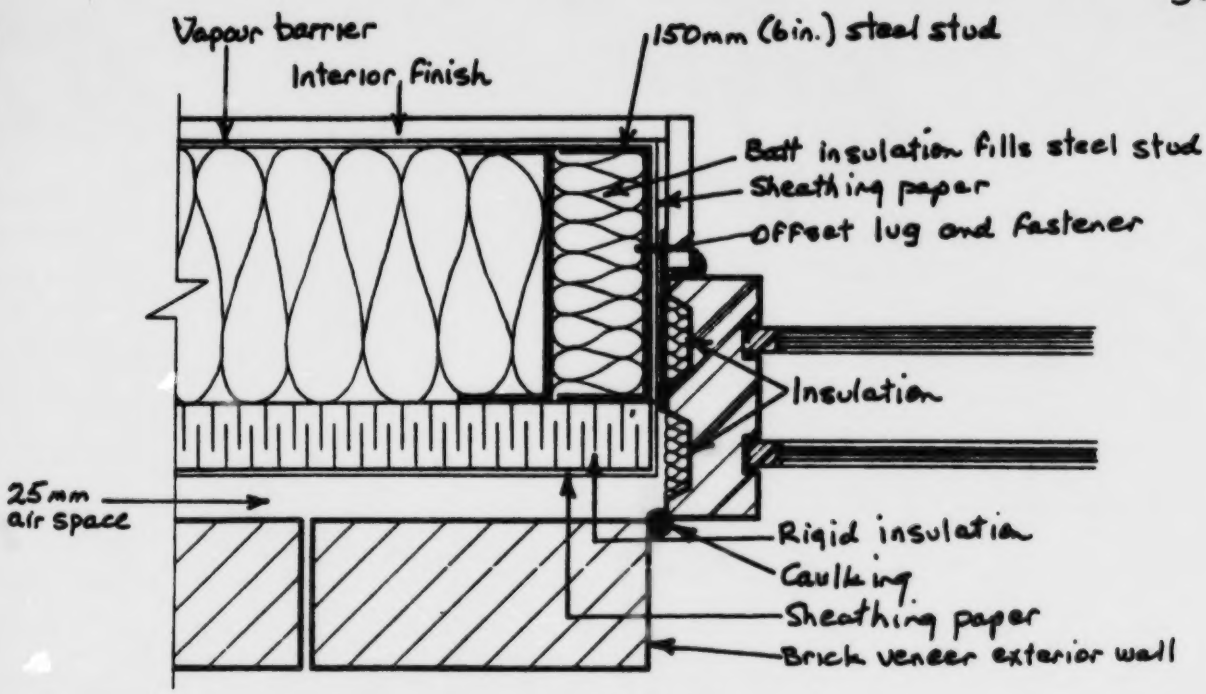
Figure 27 Where the window frame meets the brick finish, use caulking rather than pointing; caulking will not crack.

offset lugs. The type and number of fasteners used in these installations will depend on wind forces, which can be significant in tall buildings. The steel studding is covered with sheathing paper to keep condensation away from the window frames. Because the concrete ceilings have no studding, waterproofing material is spread over the concrete, across the width of the opening, to guard against moisture reaching the frame through the concrete A cross section of this type of wall is shown in Figure 28.

Placing insulation around window and door frames

The window or door should have a 12 to 20 mm (½ to ¾ in.) space all around its frame. Rip a batt of insulation into sheets and place these all around the frame (figure 29). A wide putty knife is useful for this. Pack the insulation loosely. If it is compressed, it can lose up to 50 per cent of its insulating value.

Remove snow and ice, if any, and dry the sill before placing the insulation. Do not let moisture become trapped in the space around the frame. If the space is smaller than 8 mm (3/8 in.) wide, use spray foam insulation or stuff in small layers of batt insulation, even if this means compressing it. If using spray foam insulation, practise before tackling the real job.



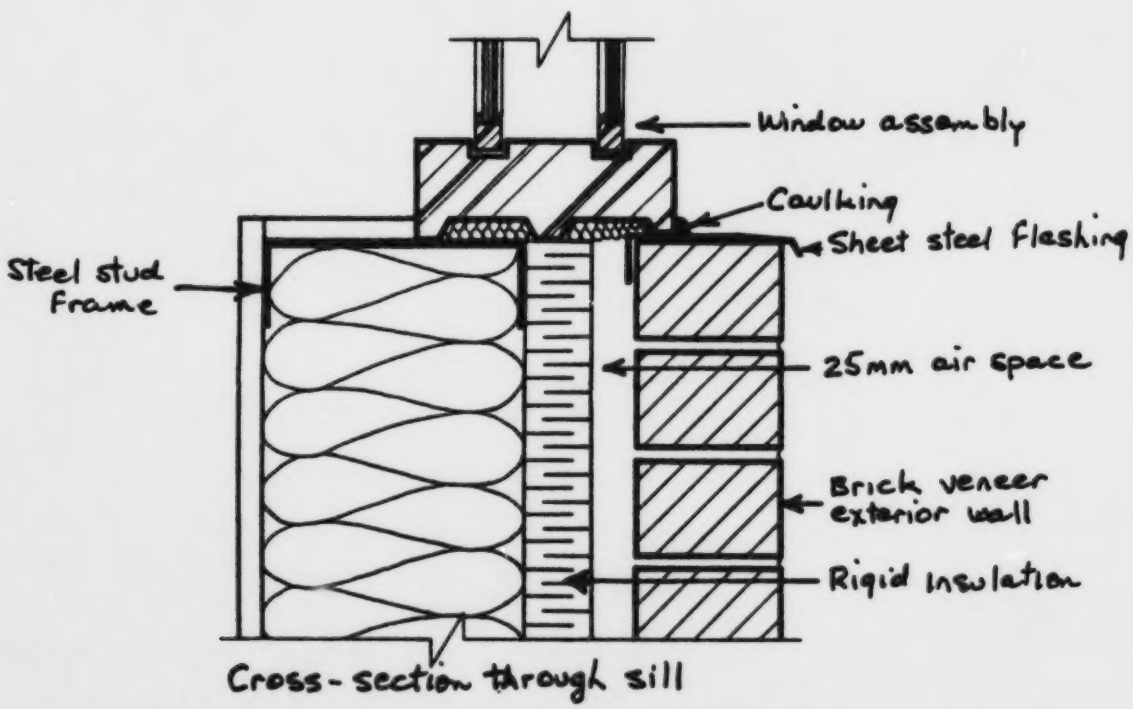


Figure 28 Window frame installation in a steel studded wall

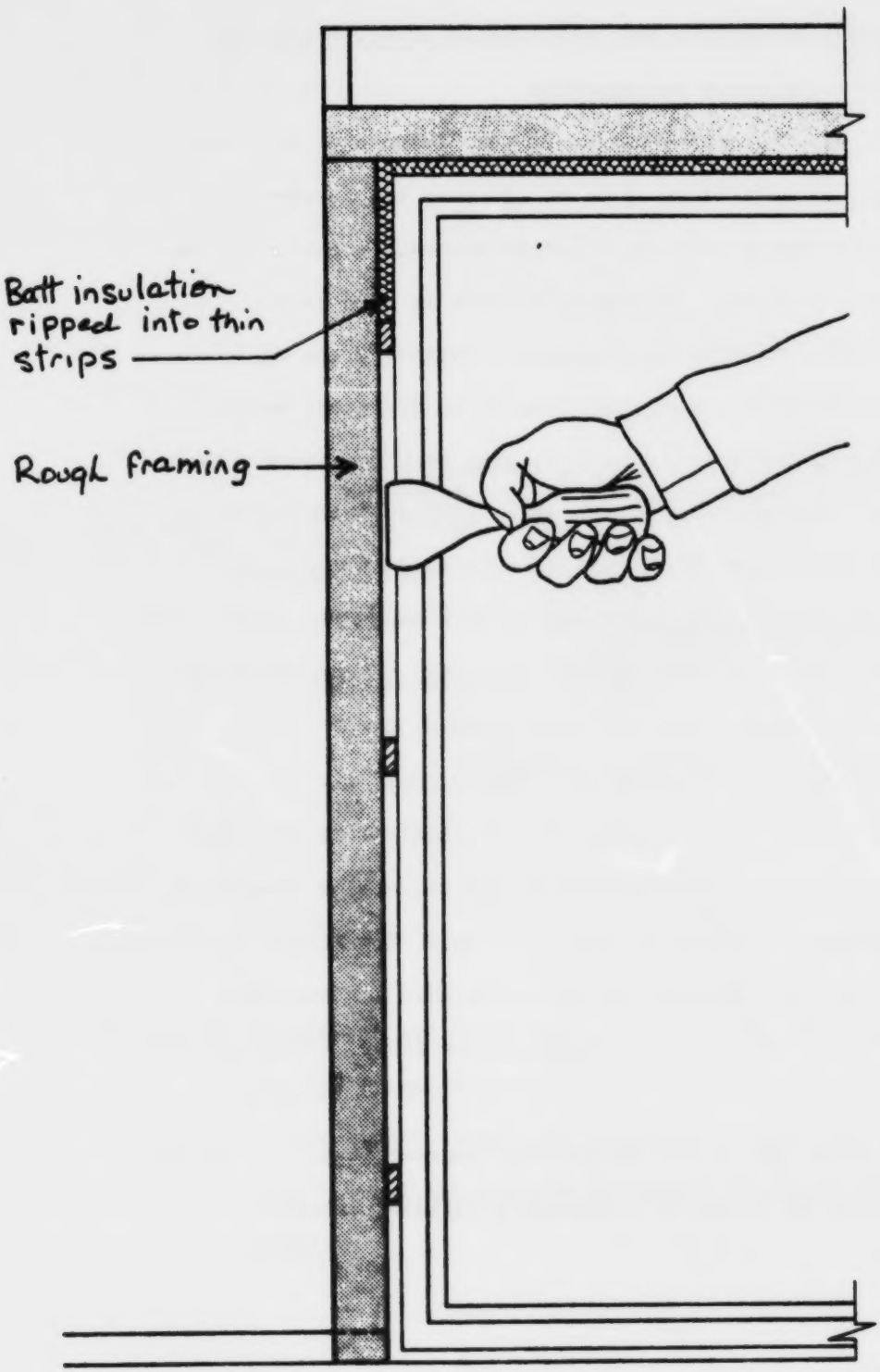


Figure 29 Place insulation loosely and to the full stud depth in the space all around the window or door frame.

Reducing air infiltration and exfiltration around window and door frames to increase airtightness

Insulation placed around a window or door frame does not stop air leakage, it only slows it down. To stop the movement of air, the wall vapour barrier should be extended right up to and over the window frame. The vapour barrier is also an air barrier because it stops air movement. Extending the wall vapour barrier up to the window frame is an efficient way of stopping air infiltration, but it is also time consuming. Many frames have jamb extensions only 18 mm (¾ in.) thick. The inside trim will later hide only 12 mm (½ in.) of the jamb face. To lap and staple the vapour barrier onto this space requires precision; it must be done with care so the fastening will not be noticeable once the trim is in place.

Another method of sealing the frame against air infiltration is by tape. Fasten the polyethelene to the rough opening and seal the crack between it and the window frame with 38 or 50 mm-wide aluminum or "tedlar" film.* See Figure 30.

Seal the space between the door threshold and the floor with caulking if the sill sits flush on the floor. Aluminum or

* "Tedlar" film tape is not an over-the-counter item. It can be ordered from 3M Canada Inc. through a building material supplier.

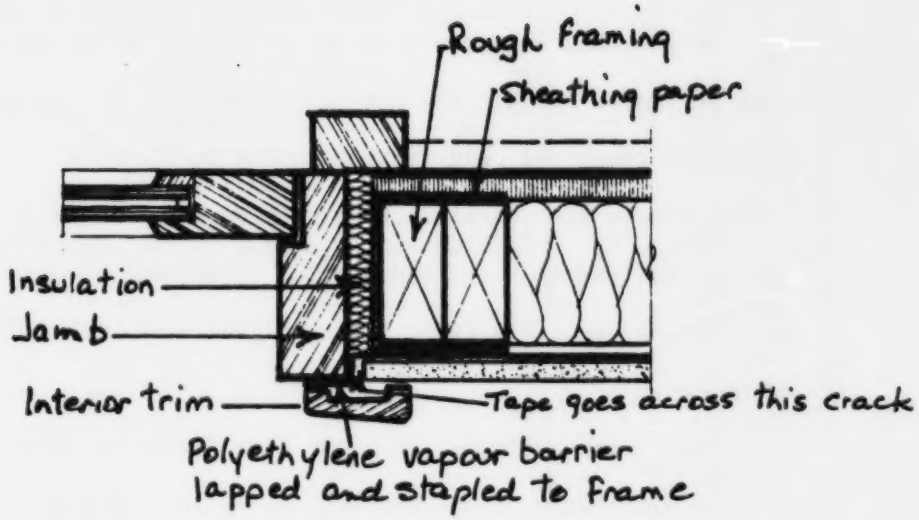


Figure 30 To prevent air infiltration between the rough framing and the frame, extend the polyethelene vapour barrier to the window frame. An appropriate tape may also be used to seal between the frame and the rough framing studs.

other types of threshold that are not of solid construction should be filled with insulation. They should then be caulked on the interior where they meet the floor.

Canada Mortgage and Housing Corporation recenly introduced a new method of installing the air vapour barrier in wood-frame construction.

This method requires a trough or groove to be cut into the door or window frame. The air-vapour barrier is then pushed into this space and held there securely by means of a narrow spline cut to fit exactly. Until the development of a flexible spline that can be wound and carried on a small reel, a shop-cut wood spline, in 1.2 m (4 ft.) lengths for ease of handling, will do an adequate job.

Wood-framed windows and doors have frames at least 30 mm ($\frac{1}{4}$ in.) wide--wide enough for a 10 mm ($\frac{1}{4}$ in.) groove to be placed in the centre. If the frame is wider than 30 mm ($\frac{1}{4}$ in.) the groove can still be placed 10 mm ($\frac{1}{4}$ in.) from the outside edge to allow the interior finish trim to be placed in its usual position. On narrow-width frames, the interior trim can be placed flush with the inside of the window or door frame. Figure 31 shows how to use this method around window and door frames.

Polyethylene sheet material has varying degrees of elasticity. Generally, the thinner it is, the greater its stretch. It is essential that enough slack be left to

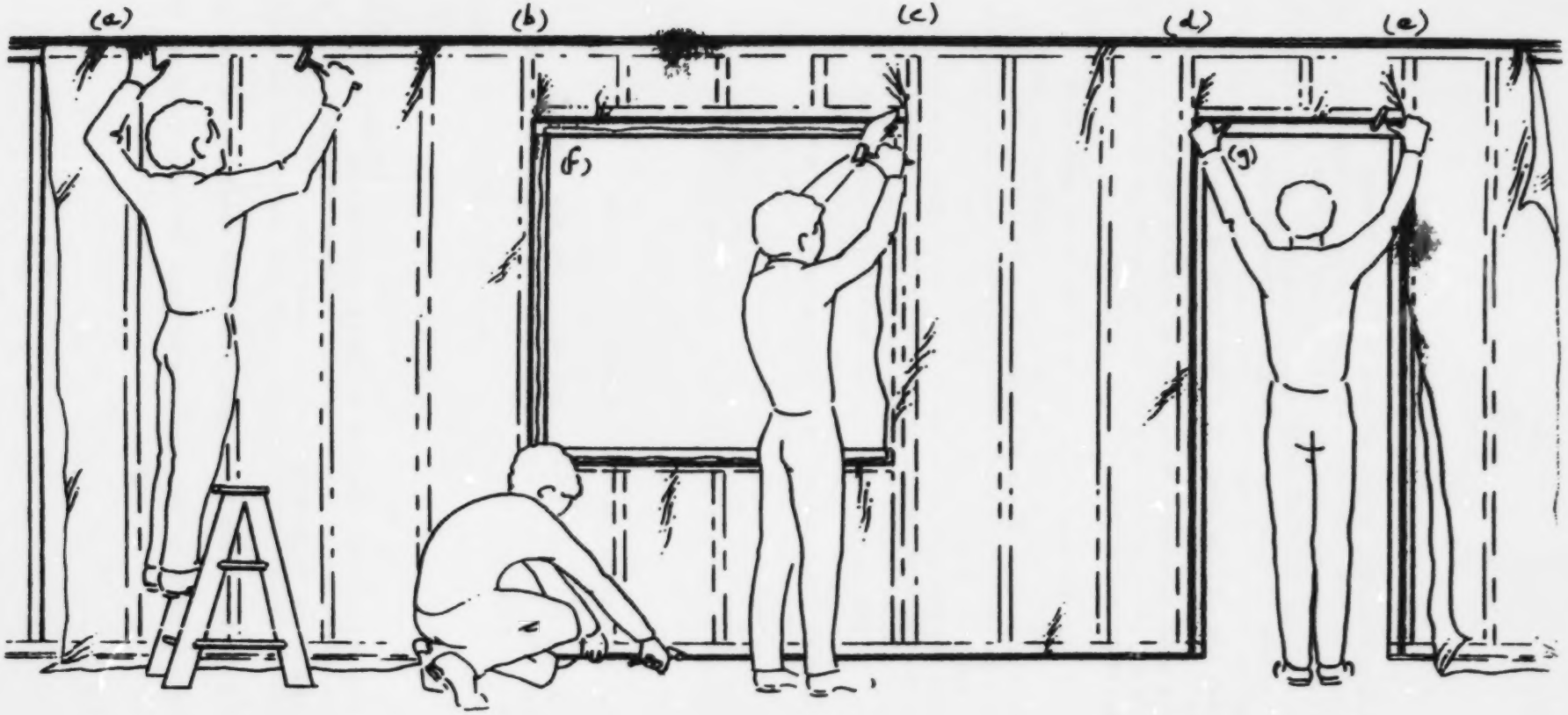


Figure 31 Cut grooves in the window and door frames. Hold the air/vapour barrier in the grooves by pressing in splines cut to fit. Be sure to leave enough slack in the air/vapour barrier that it will not tear when the spline tightens it.

accommodate its application around window and door frames without splitting or tearing when the splines are applied. Leave a slight crease or slack by folding the polyethylene back on itself so that the gypsum board or other interior finish, where it meets a door or window frame, can be applied without breaking the polyethylene sheet.

Cut a groove in the wood where the seal is to be made with a 10 mm (⅜ in.) routerbit. Place the sheet polyethylene (one or two sheets) over the groove, cut a 10 by 10 mm (⅜ by ⅜ in.) wood spline to the required length and gently force it by hand into the groove, or tap it in. The spline should fit snugly so that the polyethylene sheet cannot be easily removed; however, to ensure that it cannot be accidentally removed, hold it in place by staples or 30 mm (1¼ in.) finishing nails spaced 300 to 400 mm (12 to 16 in.) apart. For your first try with this system, practise on a small piece of timber, not on the structure itself, to see how it works and determine the exact measurements of the wood spline.

Flashing

Flashing prevents water from entering the wall section and damaging the insulation or rotting the wall materials.

Appropriate flashing must be applied over the head of windows and doors when the vertical height from the head to the roof soffit is greater than one quarter of the horizontal soffit overhang. The flashing must be brought up 50 mm (2 in.) behind the wall sheathing material and provide a drip edge. See figure 32.

Flashing is usually not part of the window or door assembly. Some manufacturers supply trim with their windows and doors and this should not be confused with flashing or used as flashing unless it conforms to the requirements of flashing.

The door or window sill must have an 8° slope to the exterior and a drip edge. To prevent stains, the water on the sills should drain to the outside edge and not towards the wall.

Staining of walls caused by dripping water is a major problem in many high-rise residential units. This is detrimental to the building's appearance, damages wood and masonry and is costly to repair.

Caulking windows

Any spaces between masonry, siding or stucco and the adjacent window or door frame and the trim, including sills, should be caulked unless these parts are completely protected from rain. The caulking compound must be suitable for exterior use and be

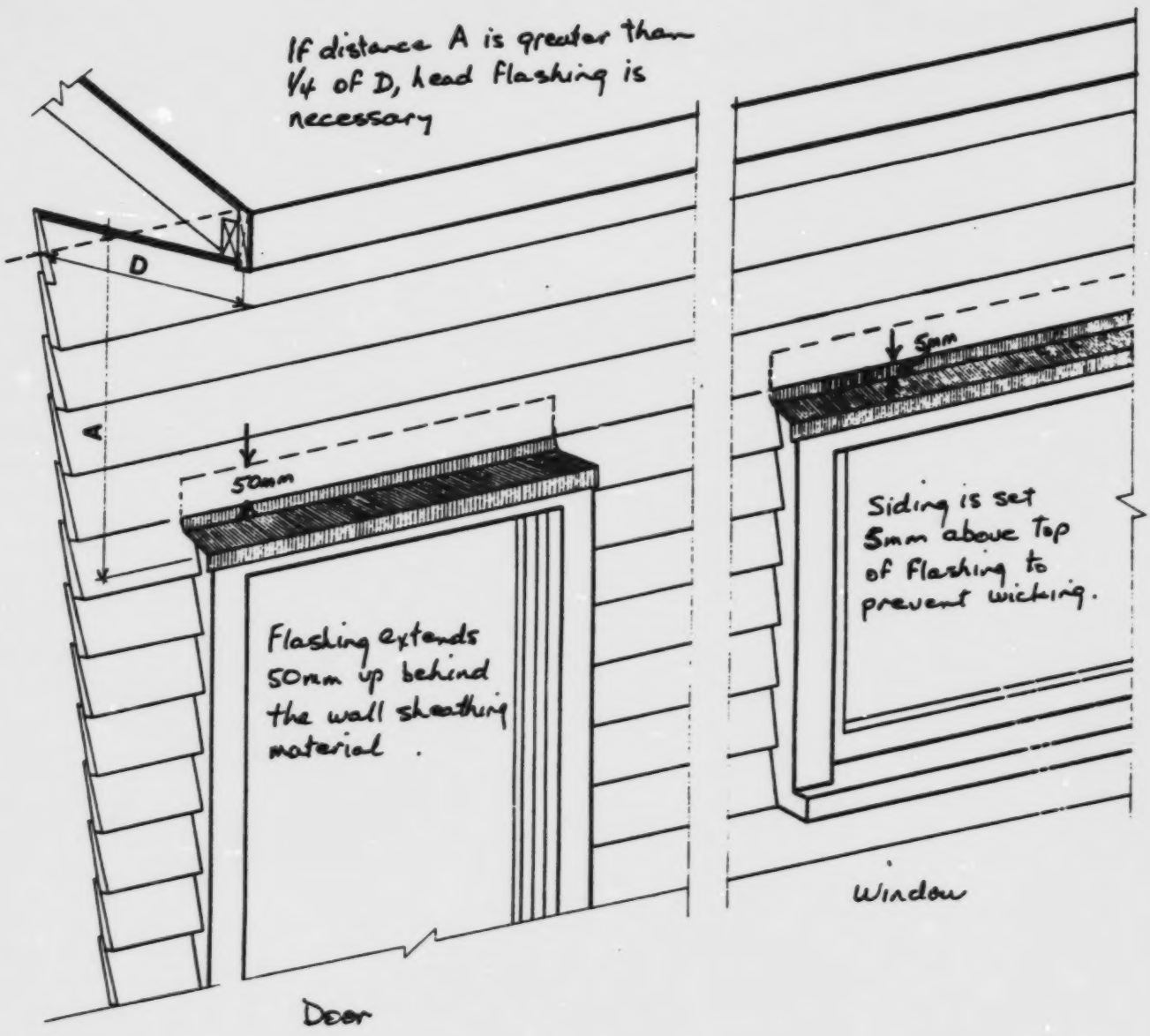


Figure 32 Flashing prevents water from entering and damaging the building fabric

compatible with both the materials it is to join or seal.

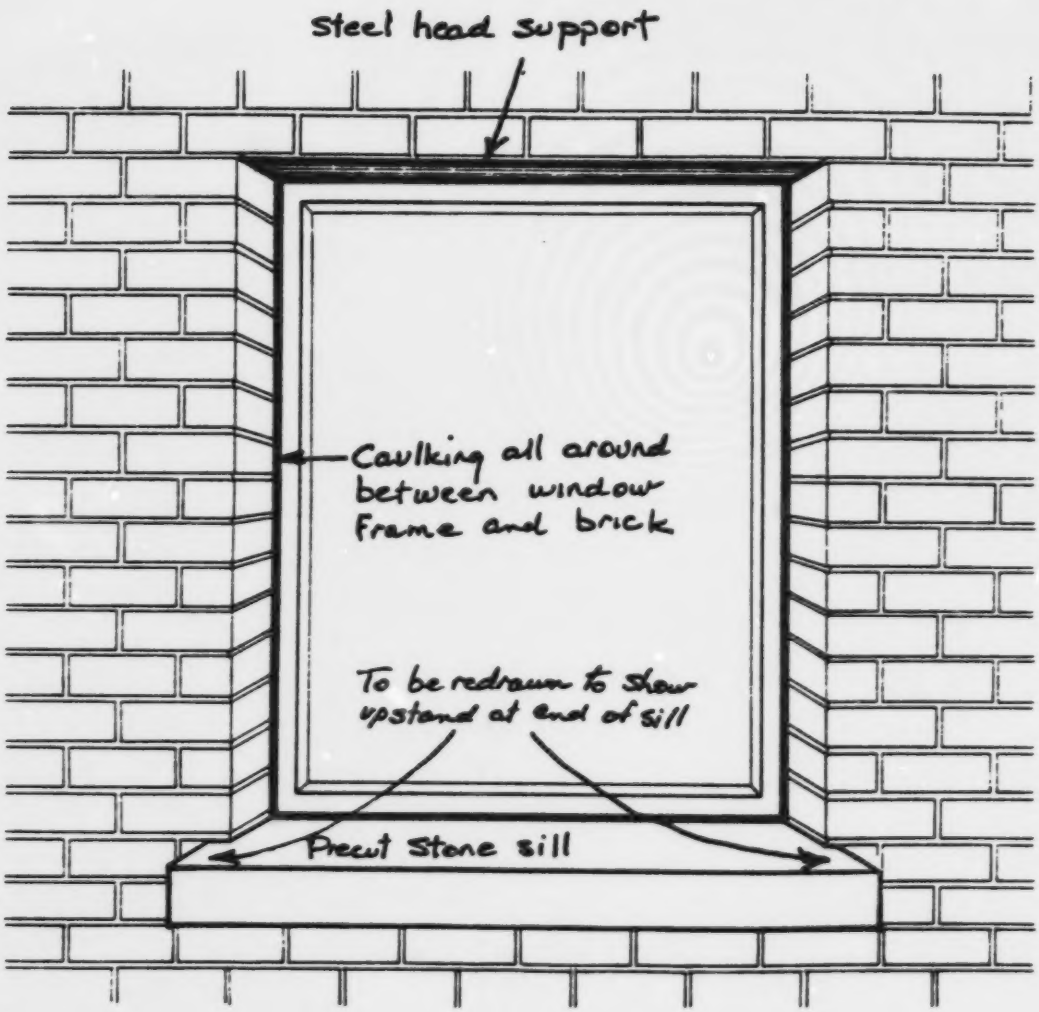
Caulking compound must adhere well but remain elastic so that joint movement does not crack it. Some caulkings cause stains and should be applied above certain minimum temperatures. Apply all sealants according to the manufacturer's instructions. See figure 33.

Common Problems

Condensation

Condensation in windows and patio doors is a common problem. Condensation can be as serious as having frost build up on the entire inner surface of an exterior pane of glass or having a little water on the sill and against the side jambs of a factory-sealed double glazed window unit.

Condensation is caused by warm humid house air coming in contact with the cold window glass or framing. Condensation can be especially severe in windows that have an exterior (storm) sash that is tighter than the interior sash, because the air is slowed down between both panes and has much more time to cool. In winter, water dripping to the bottom track may freeze and cause the window to stick. Water may also seep beneath the


Steel head support
Caulking all around between window Frame and brick
To be redrawn to show upstand at end of sill
Precut Stone sill

33
Figure 34 Caulking prevents rain from seeping into the wall.

sill and damage the insulation. To prevent or reduce condensation on windows, lower the humidity levels in the house.

Condensation cannot always be eliminated, so some means must be provided to drain away the water that drips off the storm panes. There should be weep holes in the sill or in the bottom window frame cavity to drain water away and vent moist air out. The Insulated Glass Manufacturer's Association recommends that factory-sealed double glazing units be constructed with at least three drain holes, as shown in figure 34. To avoid trapping moisture, there should be a drain hole between each of the setting blocks.

On factory-sealed double glazing window units, condensation between panes occurs when the seal breaks. Water drips down the panes and through the defective caulking seals. To avoid this problem, make sure that the visible sealants are always maintained in good repair. To repair glazing units that have failed, completely disassemble the unit, remove the old caulking and spacer bar and reassemble the window with a new spacer bar. Caulking between panes will not be required but the exterior window stop should be fitted as tightly as possible to the glazing. The space between the glass panes must also be drained to the exterior, as illustrated in figure 34. This salvage operation is labour intensive and, before proceeding, its cost in terms of labour should be conpared to the cost of a new replacement unit.

For further information on condensation, refer to CMHC's publication Condensation in the Home: Where, Why, and What to do

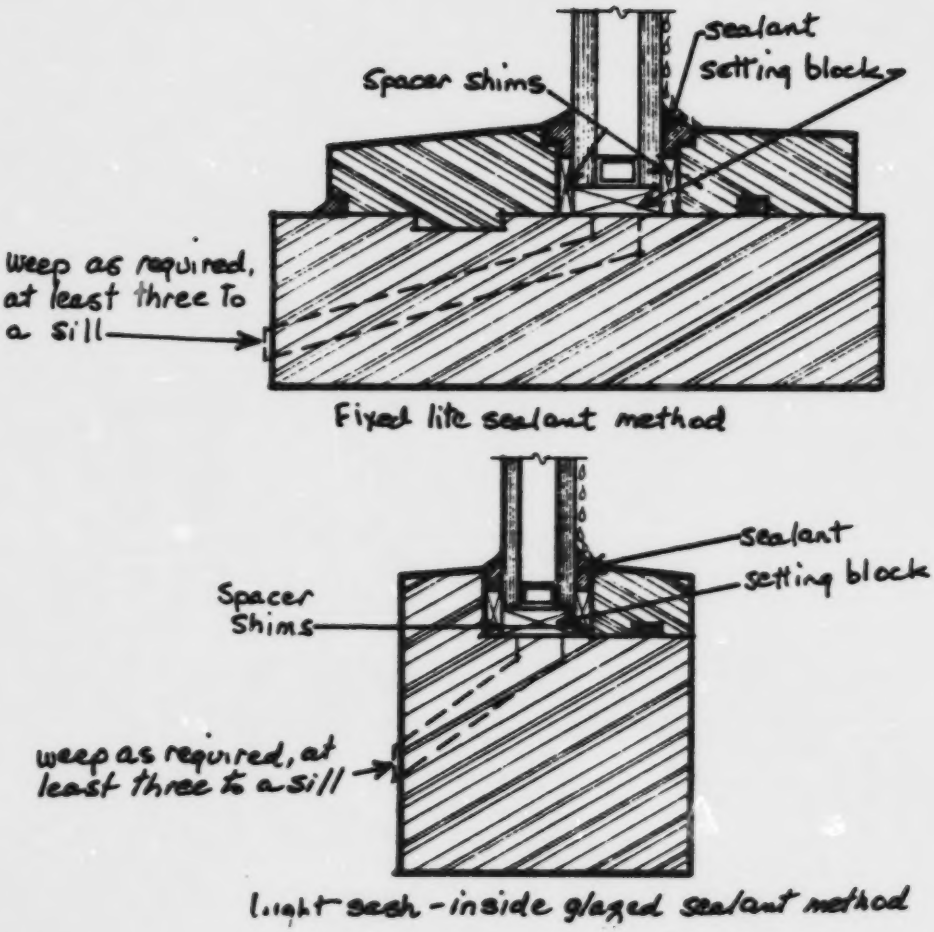


Figure 34 Factory-sealed window units normally have weep holes to drain water to the exterior.

Sticking Doors

New entrance doors may bind because they have nor been correctly hung, their frame may not have been squared or they may have swollen as a result of high humidity. Door hardware may be faulty or difficult to operate. Drafts may enter around the door because of faulty weather stripping. New buildings are under warranty by the contractor, who should be called back to repair any defects. Condensation on the lights of doors with glazings may be caused by high humidity levels in the house.

Entrance doors with storm doors on the south side of buildings sometimes have their plastic plant-on trim melt due to the "greenhouse effect". This is similar to the overheating that occurs in a car that has all its windows rolled up on a sunny day. To avoid this problem, paint the entrance door and its trim a light colour. If this does not correct the problem, the trim should be replaced by wood trim that does not distort under these temperatures.

Sticking door panels on patio doors indicate that the frame was not properly squared when it was installed. This can be corrected by raising or lowering the door's roller assemblies from an adjustment on the bottom rail. Access to this adjustment is at the ends of the bottom rails on the side or on the front face (figure 35).

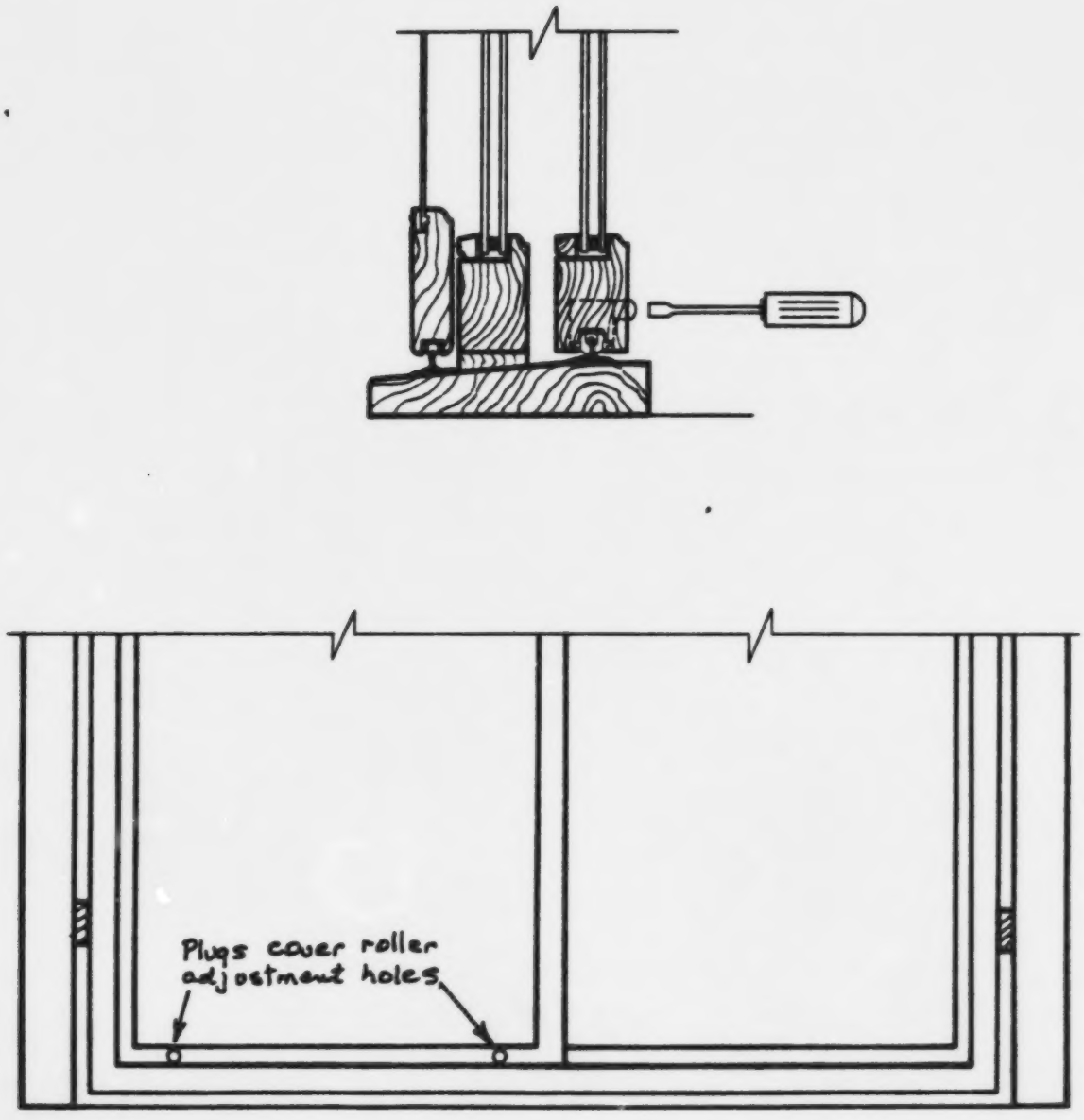


Figure 35 A sliding patio door panel can be adjusted to make it slide more easily.

Drafts through the sliding patio doors indicate faulty weather stripping. Drafts around the frame indicate that no air barrier was installed between the frame and the rough opening.

Some sliding patio doors lock automatically when they are closed. To prevent this, the door should be fitted with a deadbolt lock, which can only be locked from the inside. Make sure that sliding doors located more than one storey above ground level cannot lock automatically.

Other Factors

Protective coating for windows

Vinyl or metal clad windows are well protected from climate and insect damage. Wood windows are often treated with a clear preservative but it may be difficult to determine on-site whether a wood window has been treated or not. Check by sending a small sliver to a laboratory. Steel and aluminum windows should be finished with an enamel coating; aluminum windows can have their surfaces anodized.

Adding a screen

Window frames should be constructed to permit the installation of screens. Screens are necessary to keep insects and animals

from entering the residence. Interior screens are not removed in the winter, exterior screens may be removed to avoid damage from ice or snow.

Suite Entrance Doors

Suite entrance doors open onto interior heated public corridors or entrances. To satisfy fire regulations they must be of an approved fire separation type. This means they must be solid doors, have a fire resistant rating, self-closing devices, and thresholds that seal against smoke penetration. Often these doors are the occupant's only means of escape from or protection within the unit. They should not lock automatically when closed. Suite entrance doors should be fitted with optical door viewers or an intercom system to interview callers.

The installation procedure for a suite entrance door is the same as for exterior entrance doors, but insulations, vapour barrier and caulking are ommitted. Suite entrance doors must, nevertheless, seal tightly all around to protect against smoke penetration.

Optical door viewers

Optical door viewers in solid entrace doors permit residence occupants to view the exterior without unlocking the door (see figure 36).

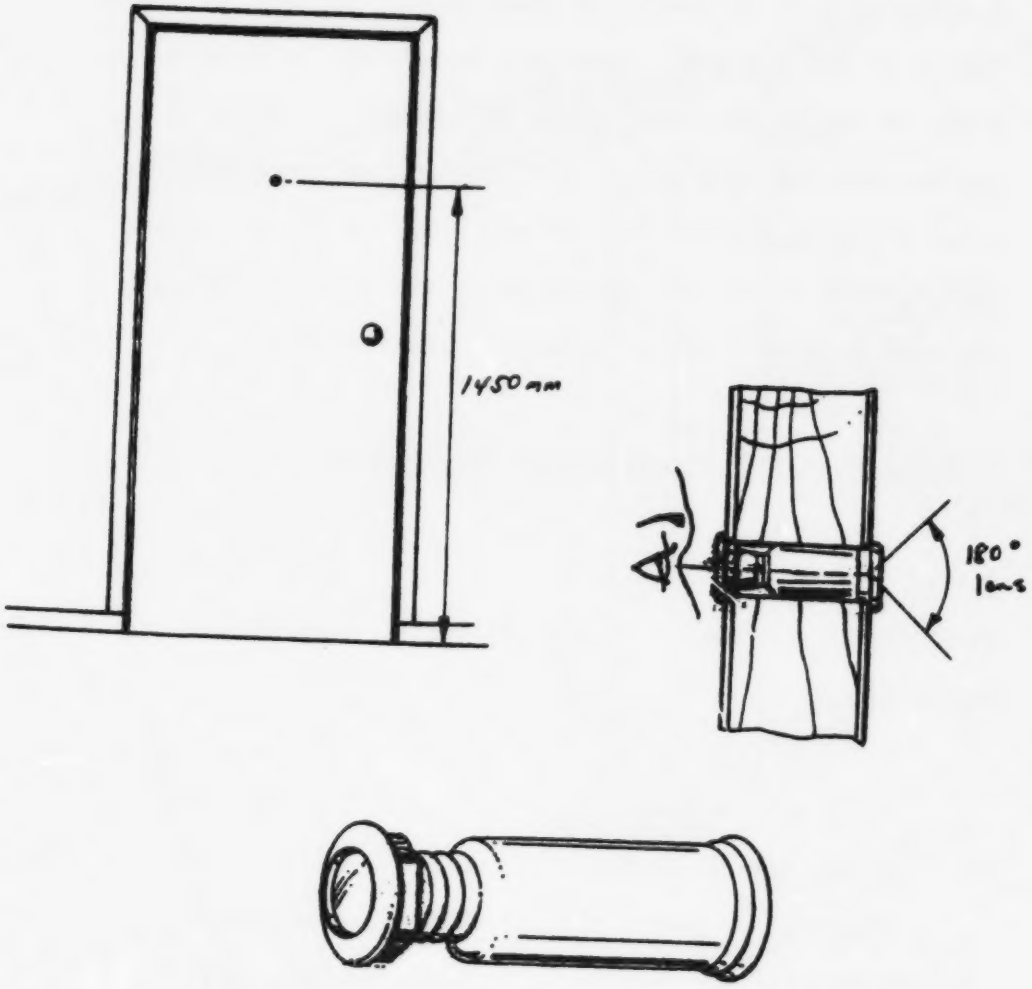


Figure 36 Optical door viewers are recommended. They permit the occupant to see who is calling without unlocking or opening the door.

Some energy conserving ideas for sliding patio doors

Sliding patio doors have large glass areas; that may be single, double or triple glazed. Heat loss through all of these is high. At night, draw curtains or shades over the doors to prevent warm air from coming into contact with the cold door panes and being cooled. If warm air ducts are placed close to sliding patio doors, add deflectors at duct exits to redirect the warm air away from the large cold glass surfaces.

Securing doors and windows against forced entry

Doors

There are several common methods of forcing entry through entrance doors:

- striking the door with the shoulder or foot to force the locks open or break the hinges loose from the door
- prying open or breaking the locks
- breaking the door's glazing or the glazing in its sidelights and reaching in to open the lock
- removing door stops or hinge pins if they are accessible from the exterior.

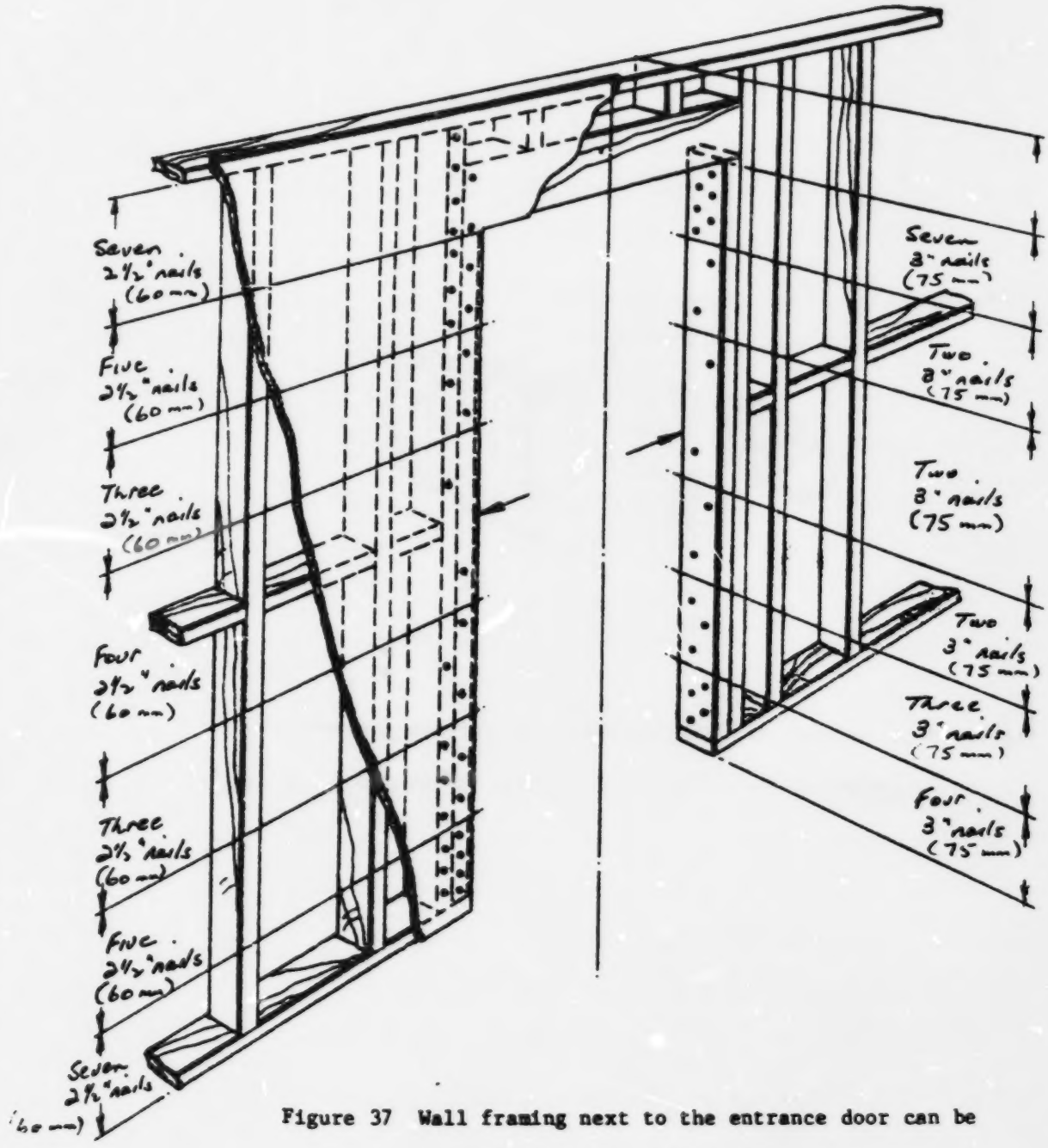


Figure 37 Wall framing next to the entrance door can be reinforced by horizontal bracing.

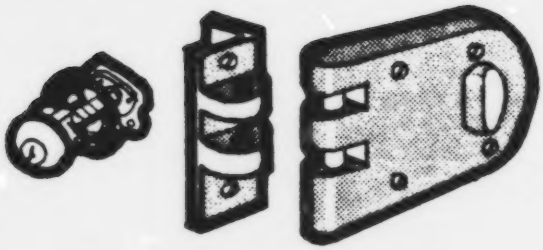


Figure 38 A vertical deadbolt lock is easy for the homeowner to install.

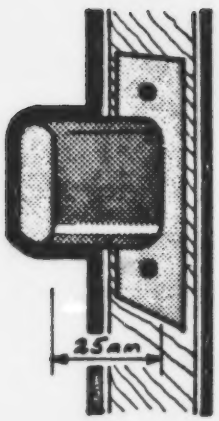


Figure 39 A horizontal deadbolt lock with a 25 mm throw.

In some cases, unlawful entry is gained by spreading the door frame and separating the lock from its strike plate. This kind of forced entry may be prevented by adding horizontal bracing between the framing studs next to the door entrance at half the height of the wall during construction (figure 37). Another method is to add extra nails to the rigid exterior sheathing material in the vicinity of the entrance. This gives the framing more rigidity.

Most illegal entry is gained through tampering or damaging the door's hardware. It is important, therefore, that the door be secured with good locks. A vertical deadbolt lock properly installed by screws that penetrate at least 50 mm (2 in.) into the studding should prevent separation of the lock from its strike plate. Horizontal deadbolt locks with a 25 mm (1 in.) horizontal throw also offer good security. See figures 38 and 39.

Sliding patio doors

Forced entry through sliding patio doors can be made by breaking the glazing, prying open the latches or lifting a sliding door panel from its frame. To increase security against prying, auxiliary locks can be added to reinforce existing ones. Consult a hardware specialist, preferrably a locksmith before buying auxiliary locks. See figure 40.

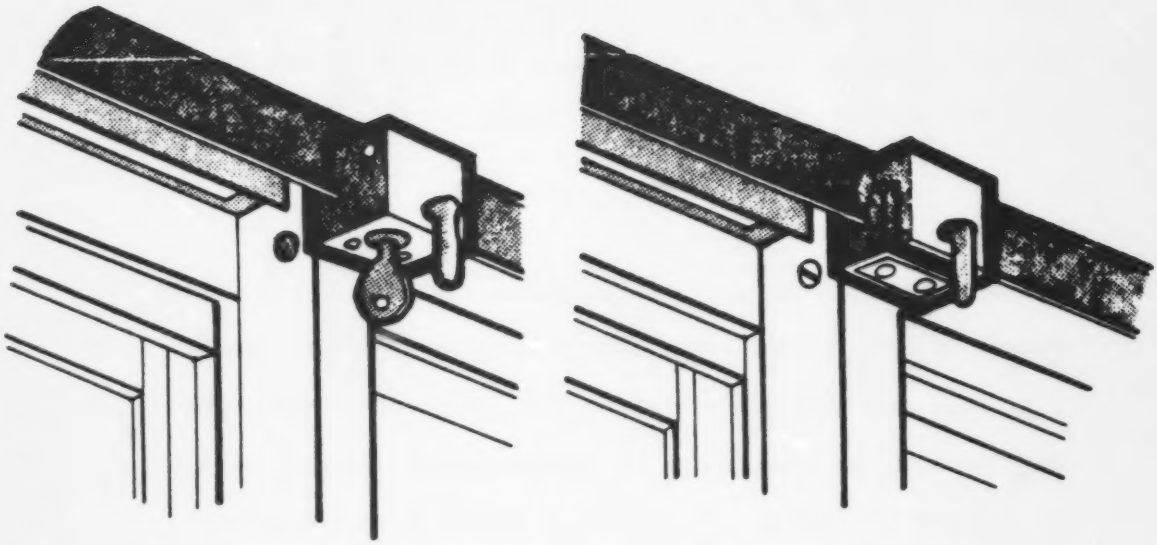


Figure 40 Types of auxiliary locks for sliding patio doors.

Sliding patio doors can also be secured by a drop bar that folds down horizontally to prevent the panels from being slid back. These bars are sold commercially (figure 41). To prevent sliding patio doors from being lifted out of their tracks, mount a screw in the top track to take the vertical play out of the door. Consult the sliding patio door distributor about the correct manner of doing this. The crime prevention unit of the police department may also be able to advise on locks and methods of securing patio doors.

Windows

Most operable windows have locks. These offer little resistance against unlawful entry. Some manufacturer's offer additional locks that work with a key (figure 42). These locks discourage entry because the sash cannot be opened without the key, even if the glazing is broken. If the screws in window hinges can be reached from outside the house, they should be replaced with one-way or non-removable screws.

Nails can be used as homemade locks on vertical or horizontal sliding wood windows. Drill holes through the inner sash into the outer sash but not through it. Insert 4 mm diameter nails, which will prevent the sashes from opening (figure 43). A wood or steel bar can be placed vertically

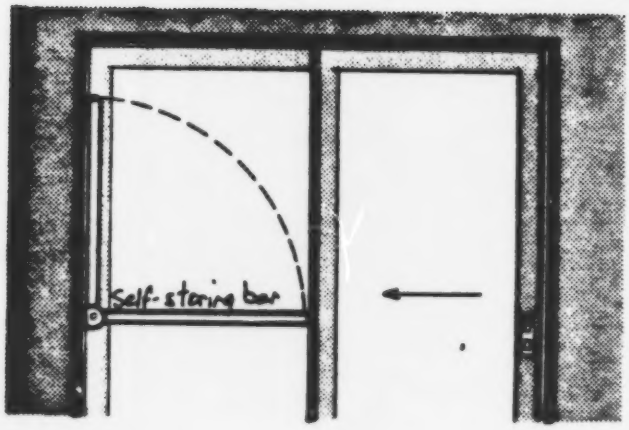


Figure 41 Sliding patio doors can also be secured by a drop bar.

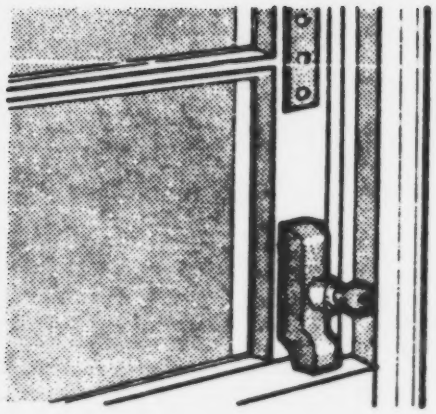


Figure 42 Key operated window locks have a bolt that extends when a key is turned. The lock can be released only with the key.

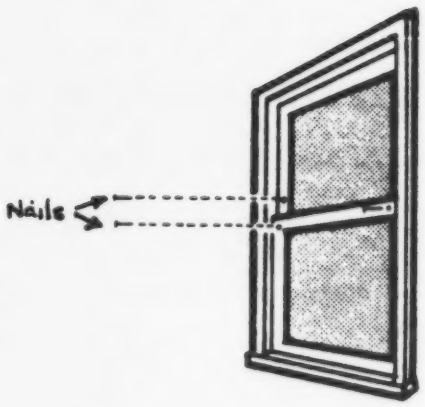


Figure 43 Use nails to make a homemade sash lock.

between the operable window sash and the top frame to prevent the sash from being opened.

Windows at basement level are often secluded or hidden by shrubbery. They are an inviting target for illegal entry. Protect them with steel bars or guards, as shown in figure 44.

Visit or call your police department. Their crime prevention unit or community relations branch is usually well informed on ways to secure windows.

For further information on securing windows agianst forced entry, refer to CMHC's publication Protecting Your Home Against Burglary, NHA 5394.

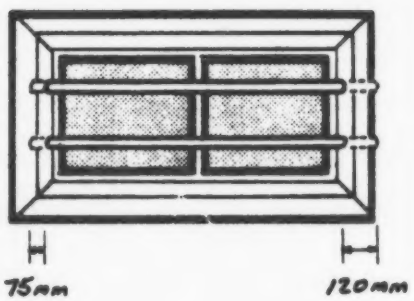


Figure 44 Use steel bars to secure basement windows against forced entry.

THE INSTALLATION OF STORM WINDOWS AND DOORS

Storm Windows

A storm window is an extra sash added over an existing window to shield it from direct exposure to the weather. Window frames should be constructed to permit the installation of storm sashes except where there is double glazing.

Removable wood storm windows

Wood storm windows are common to many older buildings that have single and double hung wood windows. Wood storms can be installed over or adjacent to the exterior window casing. They are held in place by either hooks or clips (figure 45).

To avoid condensation and frosting on the inside of the storm, do not caulk or weather strip cracks between the storm sash and the casing. These cracks will allow moisture that leaves the house through the inside window to keep on migrating to the outside.

Wooden storms also have ventilation passages in their bottom rail that can be opened to vent off excess moisture. These passages must be kept clean. Storm sashes may swell because of high humidity levels or rain. If this happens, dry them, then plane or sand as necessary.

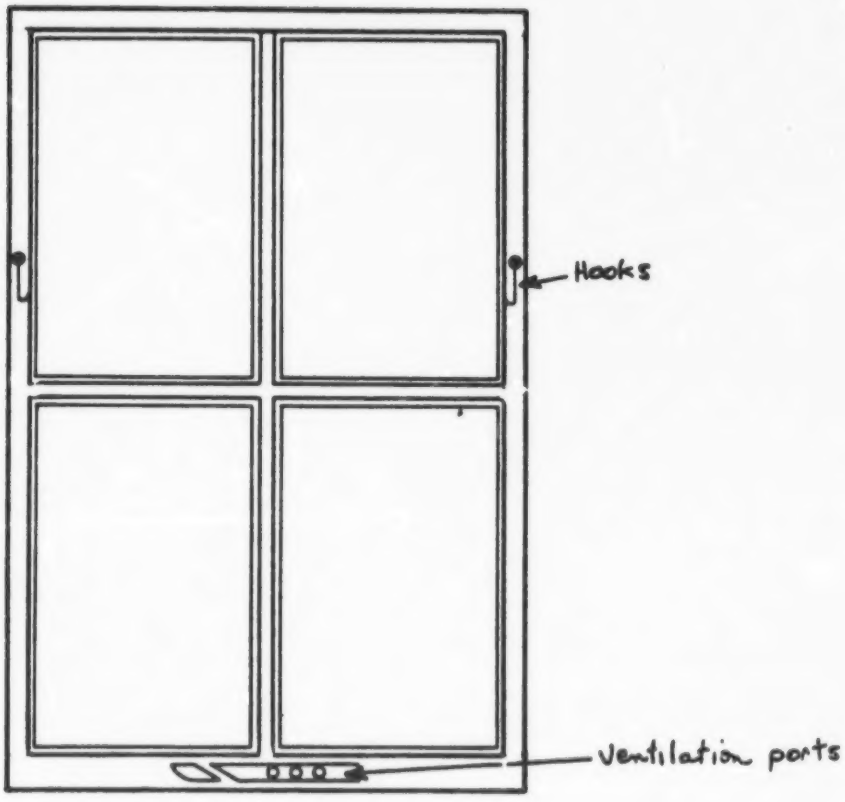


Figure 45 Wood storm windows fit into the exterior window casing. This one is fastened to the casing by hooks screwed into the storm sashes.

Wooden storms are installed in the fall, removed in the spring and stored in a dry place during the summer. Both the window frame and the storm sash that belongs to it should be coded with identical marks. Use numbering sets available at hardware stores, or mark with a chisel.

Metal storm windows

Metal storm windows are commonly used to replace the older wood type. They have operable sashes and are fixed in place permanently (figure 46). Metal storms have an outside flange that fits over the inner wood casing. This flange is caulked and then screwed down to secure and seal the storm window to the casing (figure 47).

Metal storms have drain holes to vent off moisture that may become trapped between the inner window and the storm. These drain holes are in the bottom tracks beneath the outside sash. Accumulated condensation on the outside panes leaks down into the tracks and drains out. In some storms, the vent holes are too small and become plugged. Keep them clean.

All sliding sashes remain in the window assembly all the time. The three track units simplify cleaning because the screen does not have to be removed.

To order storm windows, measure the size of the opening where the storm is to be placed. Take several width and height

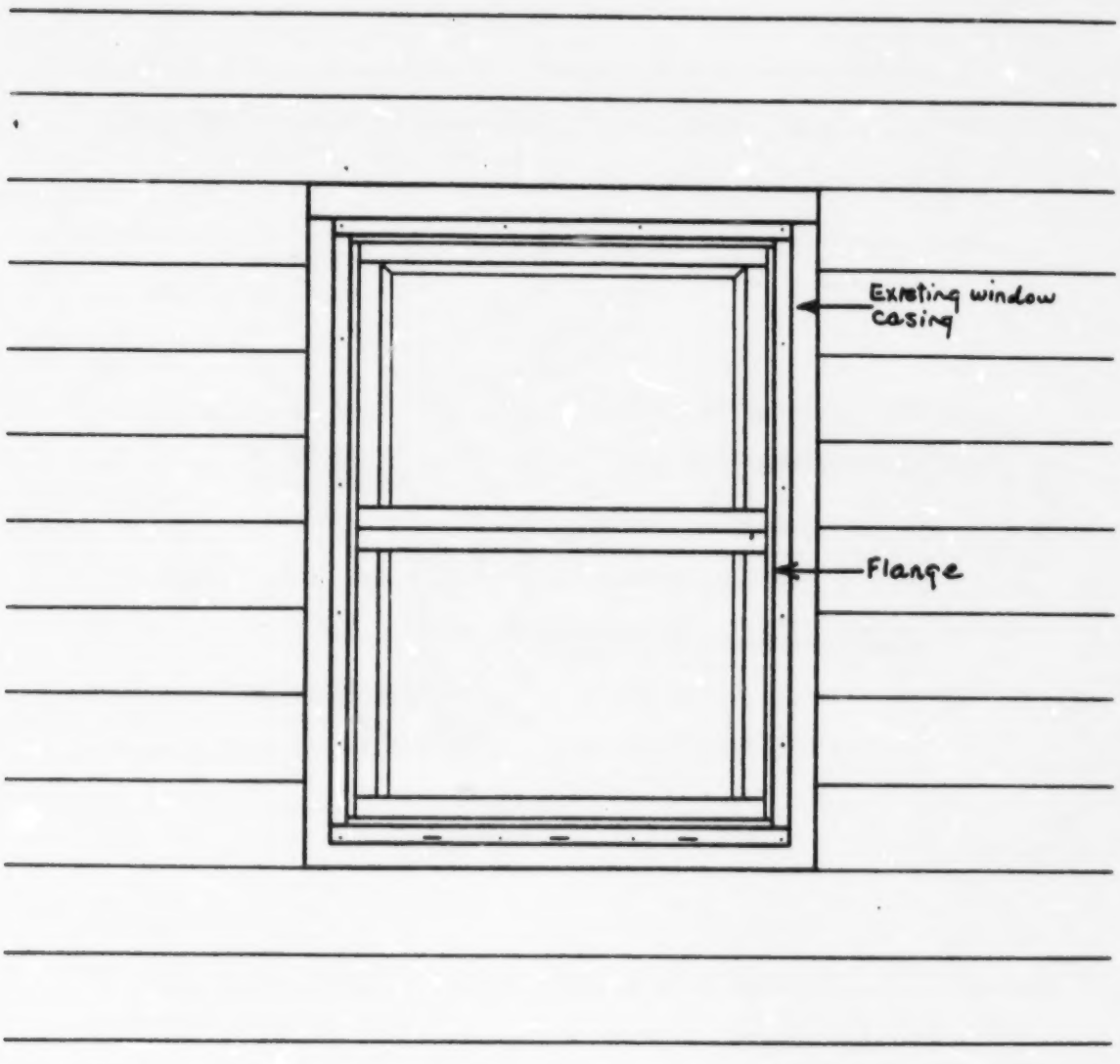


Figure 46 Metal storm windows are fastened through their flanges to the inner window casing and are fixed in place permanently.

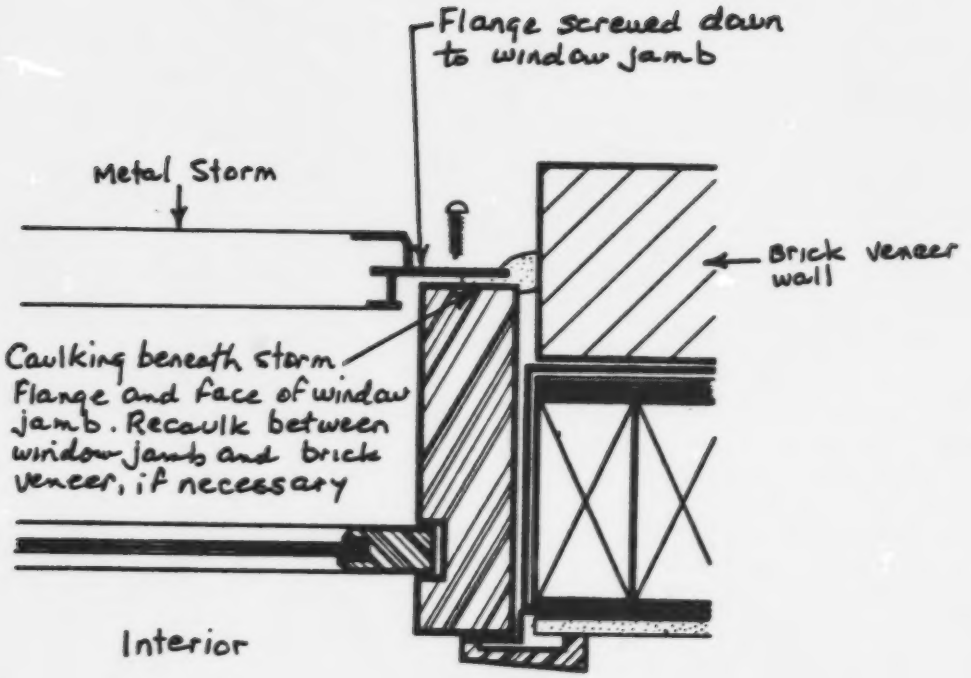

Flange screwed down to window jamb
Metal Storm
Brick veneer wall
Caulking beneath storm flange and face of window jamb. Recaulk between window jamb and brick veneer, if necessary
Interior

Figure 47 Metal storms flanges are caulked and then screwed to seal tightly.

measurements (see figure 48). If these are not consistent, the frame may not be square. On windows with butt sills, measure down from inside the top casing to the sill. Every window should be measured separately. Sketch the dimensions of each opening and use this to order the storm windows. Keep a copy of the sketch. If the new windows are the wrong size, the sketch will confirm that correct measurements were made. Storm windows have a sill expander to adjust the height.

Other types of storm windows

Some storm windows are manufactured to fit from the inside. The existing window remains on the outside and becomes the storm sash, and the original exterior window style is thus maintained. The inside storms, when tightly fitted, reduce condensation problems on single or double hung windows. These windows have considerable crack length and allow air movement around their sashes to the outside.

Storm Doors

Storm doors are usually made of aluminum or steel. Most have self-storing sashes and screen inserts; some have sashes that have to be removed and replaced by a screen for summer ventilation. Storm doors are prehung in frames which resemble the letter "Z" and are called Z bars. The outer flange of the Z

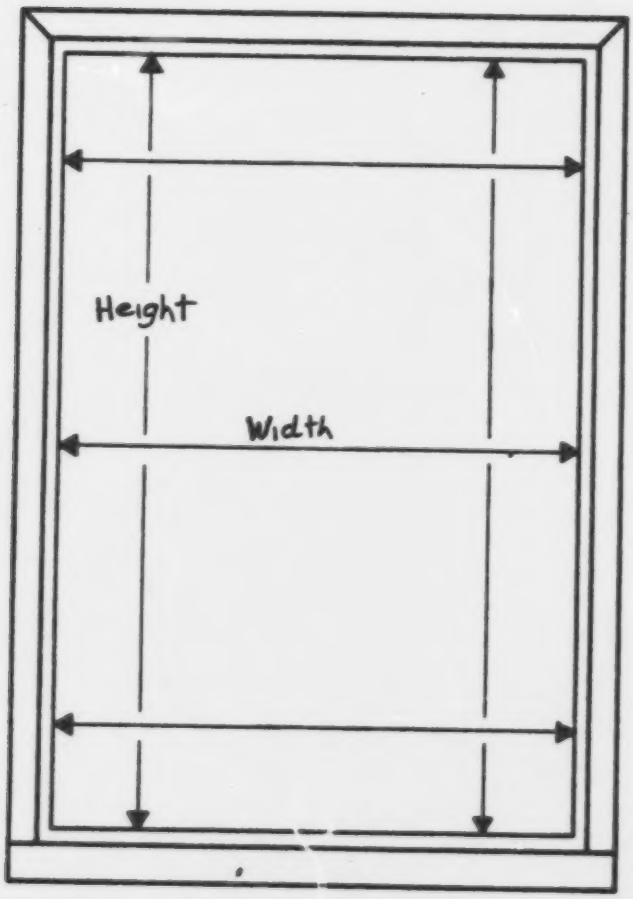


Figure 48 When ordering storm windows, take several measurements of width and height.

bar is for fastening the door to the existing casing; the web which acts as a jamb is also fastened to the casing; the inner flange is the doorstop.

A storm door frame is normally fitted between the brickmoulds. It may be possible on some older door frames to install the storm frame between casings. This is architecturally pleasing, since it allows the outer brickmould to remain uncovered. The casing must have 25 mm (1 in.) of exposed face between its edge and the brickmould (see figure 49). To order the right size of storm door, simple measure the width and the height or the opening at several places (figure 50). If the width and height measurements are not consistent, sketch them out and use the sketch to order the door. Keep a copy of the sketch. Metal storm doors have a height adjustment of the bottom to ensure tight closure over the sill.

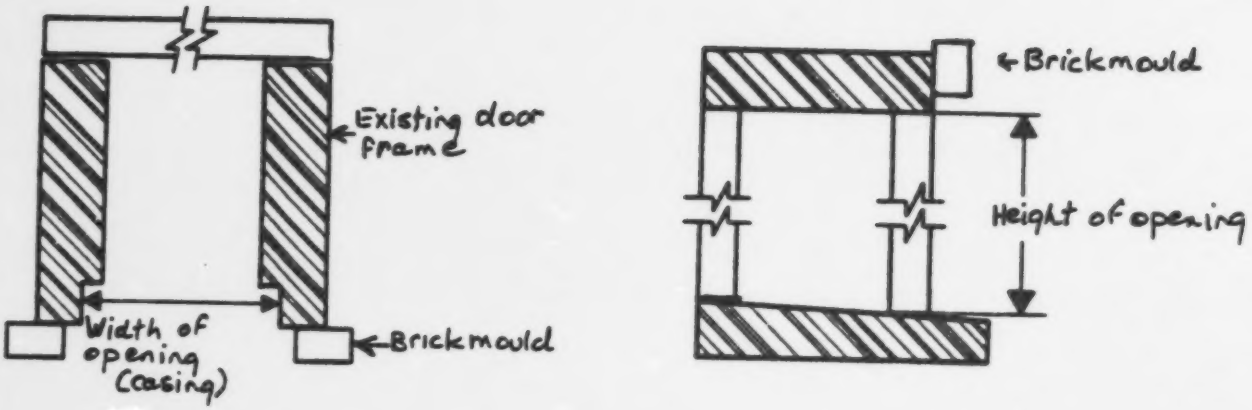


Figure 49 If the door casing is wide enough to accept the storm door's flange, fasten it to the existing frame. Measure the width to the inside edge of the door casings. Measure the height from the threshold to the inside of the top casing.

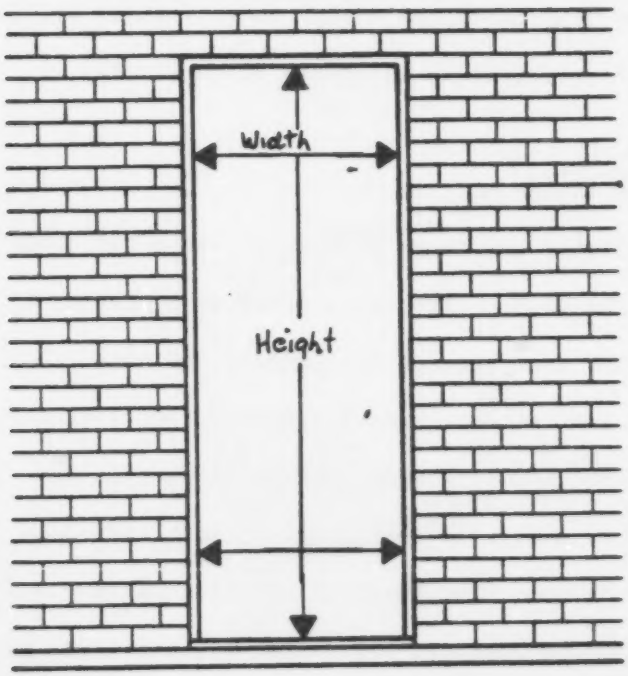


Figure 50 If the existing entrance door casing is not wide enough to accept the storm door's flange, fasten it to the brickmould. Measure the width to the inner edge of the brickmould. Measure the door height from the threshold to the inner edge of the top brickmould.

RETROFIT WINDOWS AND DOORS

Exterior windows and doors will problably have to be upgraded at least once in the life of most residential buildings. They can either be replaced by new units, rehabilitated (repaired to today's standards for appearance and energy conservation) or, in a few cases, restored (repaired to the style of their era).

Upgrading a window assembly

When retrofitting windows, decide whether it is worth the time and money to repair the window assembly instead of replacing it.

Older wood windows need regular maintenance and repair. Cracked glass panes, and cracked, loose or missing putty must be replaced. Use an appropriate caulking instead of putty. See figure 51. Caulking is available in several colours, and does not crack like putty or need painting. If paint is peeling and cracked, scrape it off and repaint. If sashes are difficult to operate, they may be wedged in against the weather stripping, bonded to the tracks by dried paint or dirt, or swollen through humidity. Use a wide putty knife to cut through the dried paint and pry the sash open. Window stops may have to be removed to unbind the sashes.

Once removed, the sashes should be cleaned, dried and then sanded or planed so they move freely in their tracks. If the

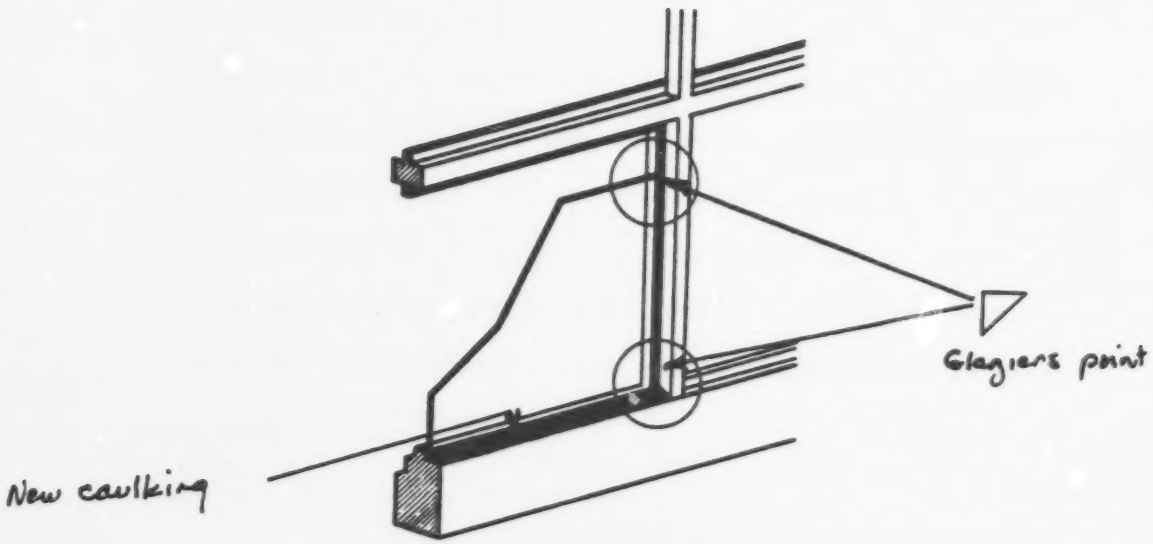


Figure 51 Remove cracked glass panes from wood frame, clean out old putty, reglaze and caulk.

sashes are badly swollen, the window stops may have to be reset. Badly broken or damaged sashes can be repaired in shops that specialize in this type of work or they can be replaced by custom built sashes.

Repairing a broken sash cord

Sash cords support weights that hang behind the window frame and counterbalance the sash, keeping it in a raised position. When these cords wear out and break, the weights fall in behind the window frame and the sashes no longer stay in the raised position. To repair a sash cord, remove the access plate from the bottom of the window jamb. Retrieve the weights and replace the cord with a waxed cord or chain—these will wear longer. If there is no access plate, remove the interior trim. See figure 52.

Repairing or replacing a window sill

In old wood window assemblies the exterior window sill is often badly weathered from its exposure to water, snow and ice. Cracked and peeled paint leaves the wood unprotected. Cracks in the sill that show no evidence of rot should be filled with an exterior wood fill compound and the sill repainted. If the sill is rotten, it should be replaced.

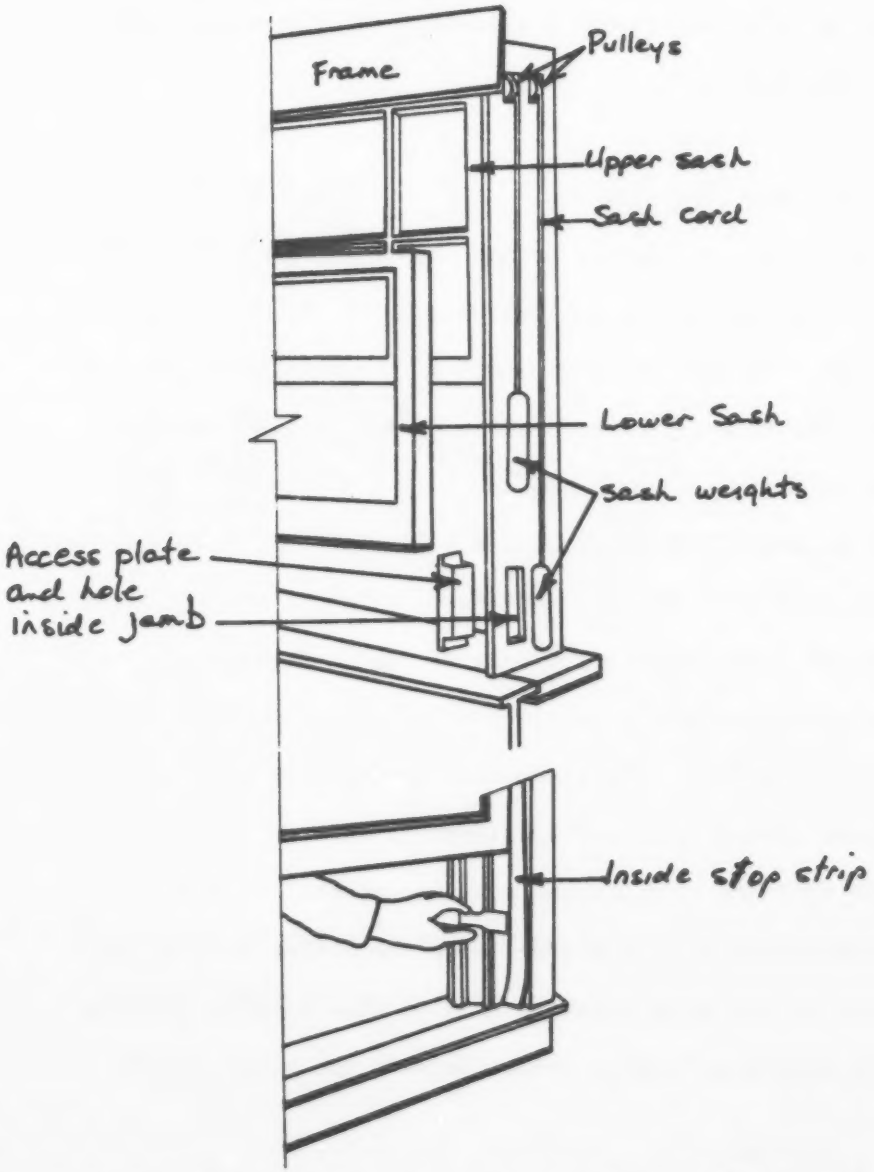


Figure 52 Repair a broken sash cord by retrieving the weights through the access plate.

Remove the rotten sill by cutting it in half or in several places. These cuts will allow the sill to be hammered and pried up and out. Be careful not to cut the window's stool since this has to be reused. Use the old sill as a model for fabricating the new sill. Make sure the new sill has a routed drip edge. Replace the sill and fasten and caulk it to the window side jambs. See figure 53.

Upgrading a door assembly

Doors may close too tightly or not tightly enough. Older doors and their casings may be swollen because of humidity. In older houses whose foundations have settled, the door frame may not be square. The exterior exposed surfaces may be badly weathered and the interior surfaces cracked.

If a wooden door is binding due to swelling, remove it and plane or sand it. Set the plane for a thin cut and put the door back in its frame after a few cuts to avoid overplaning.

An effective way to reduce the warping of a wooden door is to add a storm door. The storm door reduces the temperature difference through the door and keeps it drier.

The door may bind because of loose screws or poorly installed hinges. In this case, move the hinges further into the frame at the hinge location or move them outward from the frame by inserting a metal spacer between the hinge and the frame.

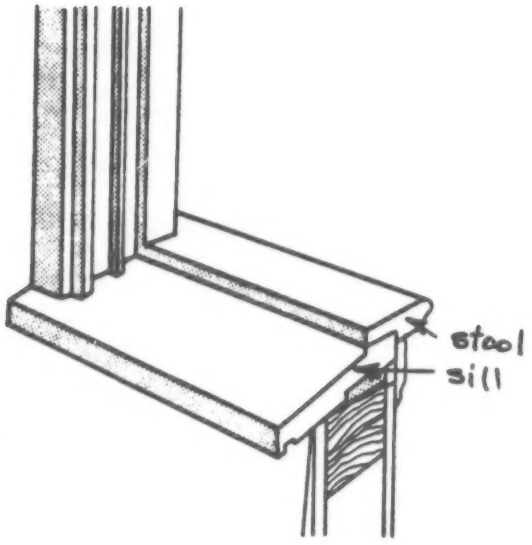


Figure 53 Remove the old sill by cutting in half or in several places and cutting out the bits.

To increase or decrease the door's closing pressure, readjust the strike plate or weatherstripping and relocate the door stops.

If entrance doors are not protected by a storm door they will become badly weathered. Clean and paint them regularly. See figure 54.

Replacing a door's threshold

Older door thresholds are usually made of hardwood. Over time, the threshold becomes worn down and weathered. Remove the old threshold, the same way as for window sills (figure 53). The threshold can then be pried up and the pieces used as a pattern to make a new threshold. Make sure that the threshold has at least an 8° slope to the exterior and extends out past the exterior wall.

It may not be possible to find a piece of hardwood as thick as the old threshold, in which case, use a thinner piece and shim. Fasten the threshold by toenailing it to side jamb through to top surface. To avoid splitting the hardwood, pre-drill guideholes. Countersink all fasteners and fill their heads with a wood filler compound.

Caulk between the threshold and the floor and where the threshold meets the side jamb. Metal thresholds can be purchased and used as replacements. These are available in

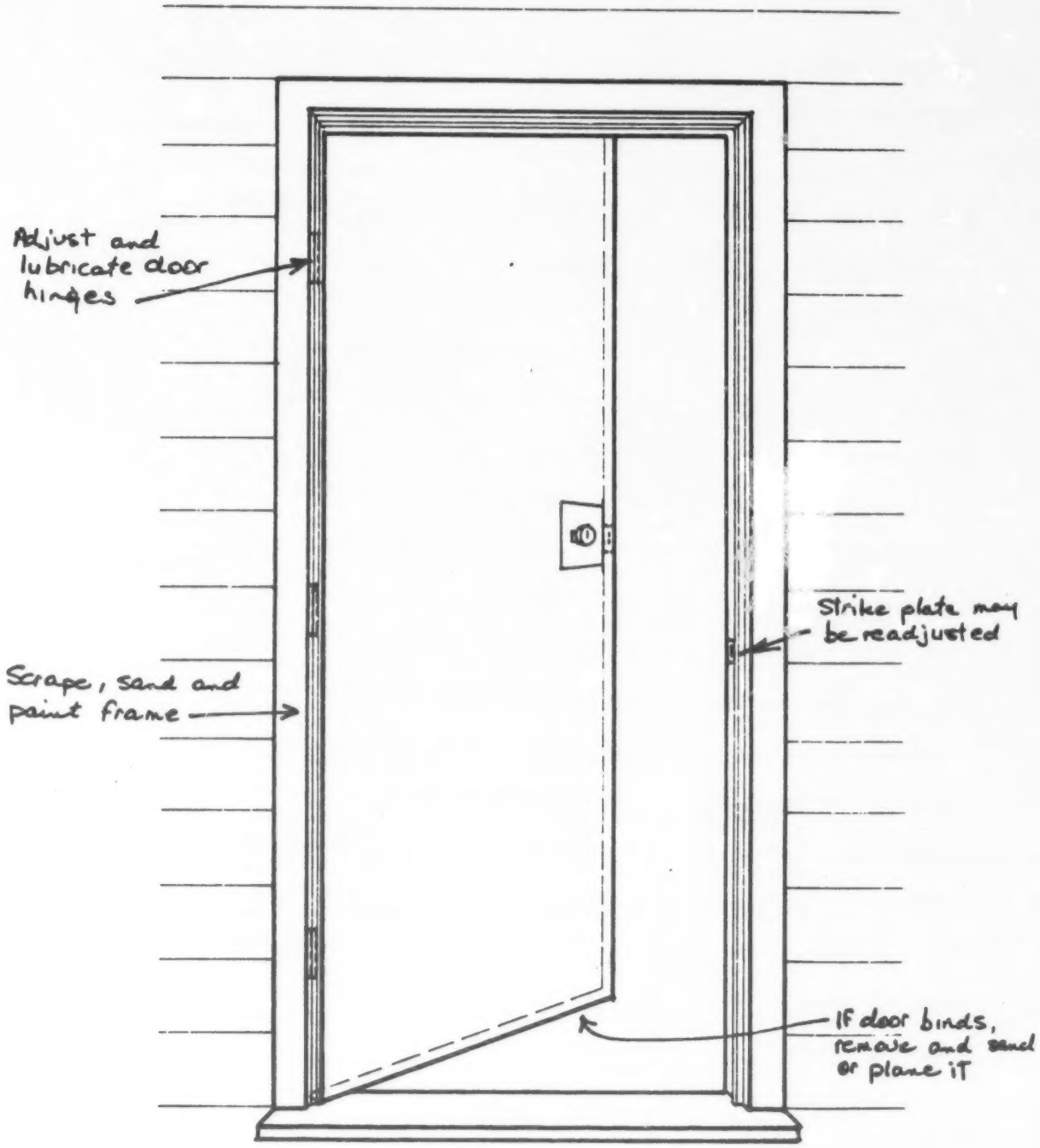

Adjust and lubricate door hinges
Strike plate may be readjusted
Scrape, sand and paint frame
If door binds, remove and sand or plane it

Figure 54 Keep doors in good shape by regular maintenance.

several shapes and with various types of vinyl inserts for weatherstripping.

Upgrading the insulation and reducing air infiltration around the door or window frame

In old houses there is often very little, if any, insulation around the door or window frame. Weather stripping, if present, is often deteriorated. Remove the interior trim and check the insulation around the frame. To remove the trim, use a nail set to drive the finishing nails through it or pry the trim off by using a thin pry bar or chisel. Some of the nails may remain attached to the frame and these can be pulled out by a hammer. Those that remain attached to the trim, can be removed through the trim from the back by rolling them out with a pair of carpenter's pincers. If there is any doubt about the value of the existing insulation around the frame, remove it and reinsulate. Insulate in the same way as for new windows or doors. To reduce air infiltration around the frame, caulk the space between it and the wall framing or apply aluminum tape over the wood surfaces. If caulking, use an acrylic latex caulking compound and follow these guidelines:

- the smallest joint size for caulking should be 6 mm x 6 mm (¼ in. x ¼ in.)

- generally, a small caulking joint should have a depth equivalent to its width
- the depth of insulation should be such that it can provide a backing for the caulking joint.
- the width of the caulking joint should not be more than 18 mm ($\frac{3}{4}$ in.). The depth of these large joints should be not more than 13 mm ($\frac{1}{2}$ in.)
- cut the nozzle on the caulking tube to match the size of the space to be filled; cut the nozzle at an angle to obtain an 18 mm ($\frac{3}{4}$ in.) bead
- immediately after the caulking is in place, tool it by running a finger over the joint to ensure that the caulking is pressed into the crack and touches and adheres to both sides of th joint.

Adding replacement weather stripping to windows and doors

Weather stripping is added to operable windows to seal the window sashes. Awning and casement windows have a crack all around their perimeter; sliding windows have a crack all around their perimeter and a gap in the centre where the two sash rails overlap. Weather stripping these cracks reduces air infiltration and exfiltration through the window unit. Reduced exfiltration will lower condensation on the storm panes; storm

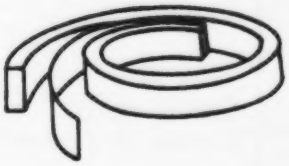
panes should not be weatherstripped. Figure 55 shows some of the many types and shapes of weather stripping materials.

Old weather stripping that is cracked, worn or of poor design should be removed and replaced. Weather strip all inner operating sashes. Figures 56 to 58 show weather stripping for different types of windows.

Plastic windows have a groove for weather stripping. Replacement weather stripping should be put in the same place. In some circumstances, adding replacement weather stripping may be difficult. There are firms that specialize in this work. They use equipment to change a building's air pressure and thus identify air movement through cracks; these are then sealed with caulking or weather stripping.

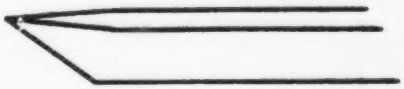
Many older doors do not have weather stripping, or their weather stripping is of poor quality, improperly adjusted or worn out. Weather stripping around doors reduces air infiltration and, thus, heating costs. If there are storm doors, these should not be weather stripped. Moisture that leaks through the entrance door must be permitted to exit to the outside. The different types of weather stripping were shown in figure 55. When installed on door frames, weather stripping is placed on both side jambs and above the door. See figures 59 and 60.

Tubular strips are made from a synthetic rubber (ethylene propylene terpolymer, EPDM), plasticised PVC (polyvinylchloride), spun fiber or cotton, and are fastened with tacks or staples. The strips act in compression to seal against a surface.



Foam strips have adhesive backs or are mounted on rigid backing.

Pile strips are made from closely woven textile yarns interlaced on to a backing. They are usually slid into a slot and anchored.



Angle strips are made from synthetic rubber of plastic and are mounted with tacks or staples, or they may have self-adhesive backs. These strips may be called tension strips when the strip pushes out to seal an opening.

Spring metal strips are made of bronze, aluminum or stainless steel, and are fixed in place with nails and act in tension.

Figure 55 Various kinds of weatherstripping

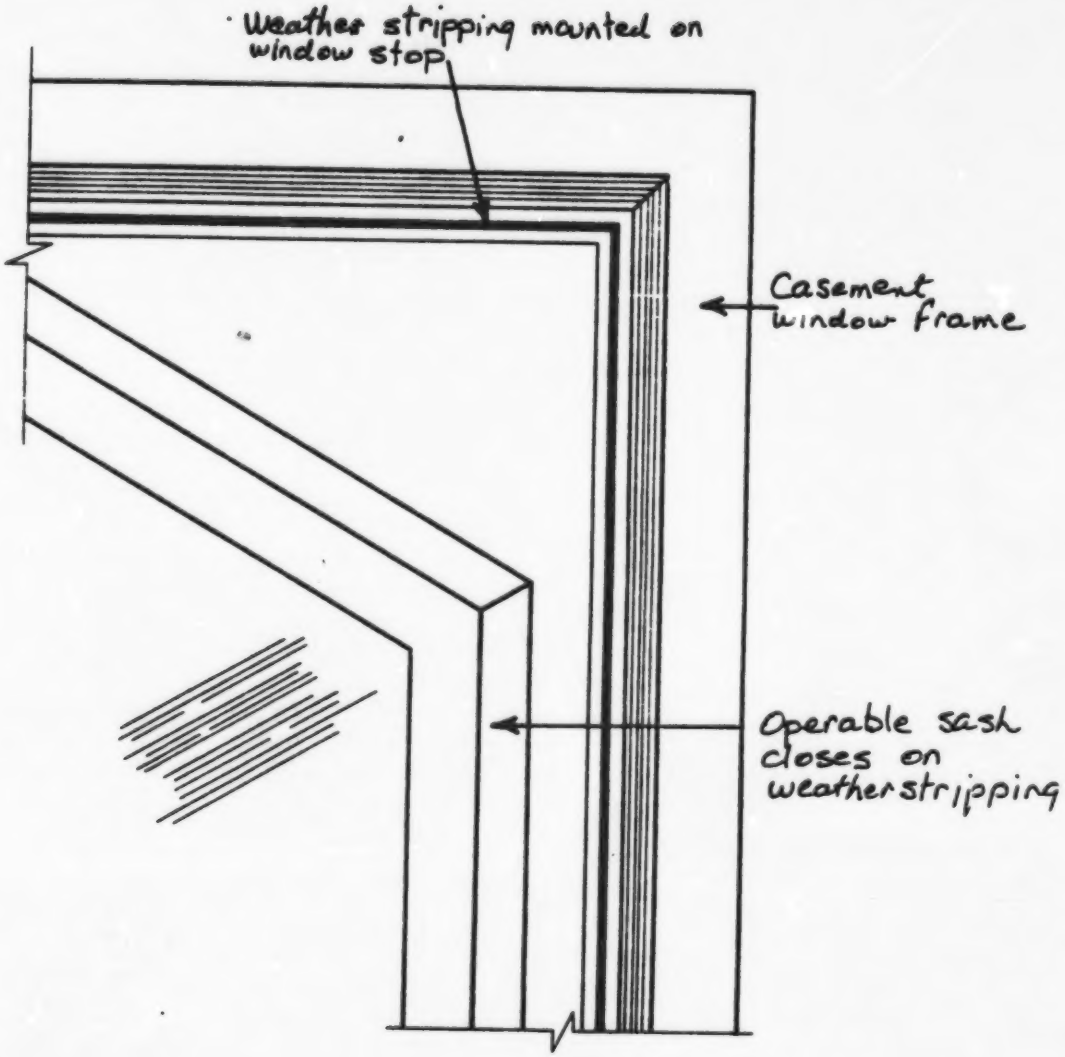


Figure 56 Adding replacement weather stripping to a casement window. When compression weather stripping is used in casement windows, it is compressed by the closed window.

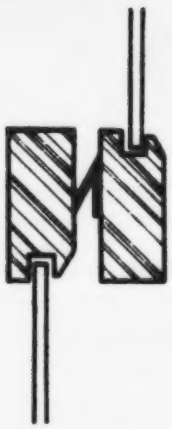


Figure 57 Adding replacement weather stripping to a ~~single~~ double hung window. Angle strips or tension strips are designed to seal between two sliding surfaces, as in single hung windows. Remove the lower sash and fasten the angle strip in the track on both side jambs and on the lower rail of the upper sash.

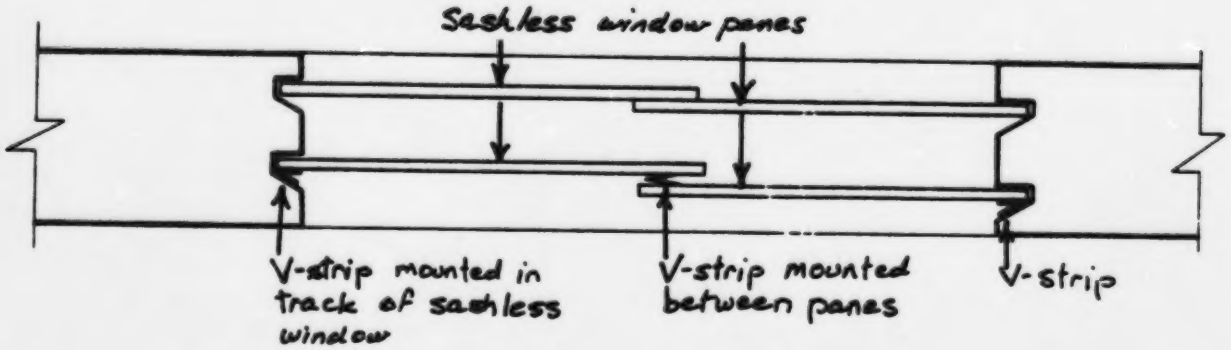


Figure 58 Adding weather stripping to sashless windows. Sashless windows allow high levels of infiltration. Remove the inner glass panes and weather strip the inner tracks on the side jambs and the top. The bottom grooves cannot be weather stripped. Make sure that sashes can still be easily removed for cleaning.

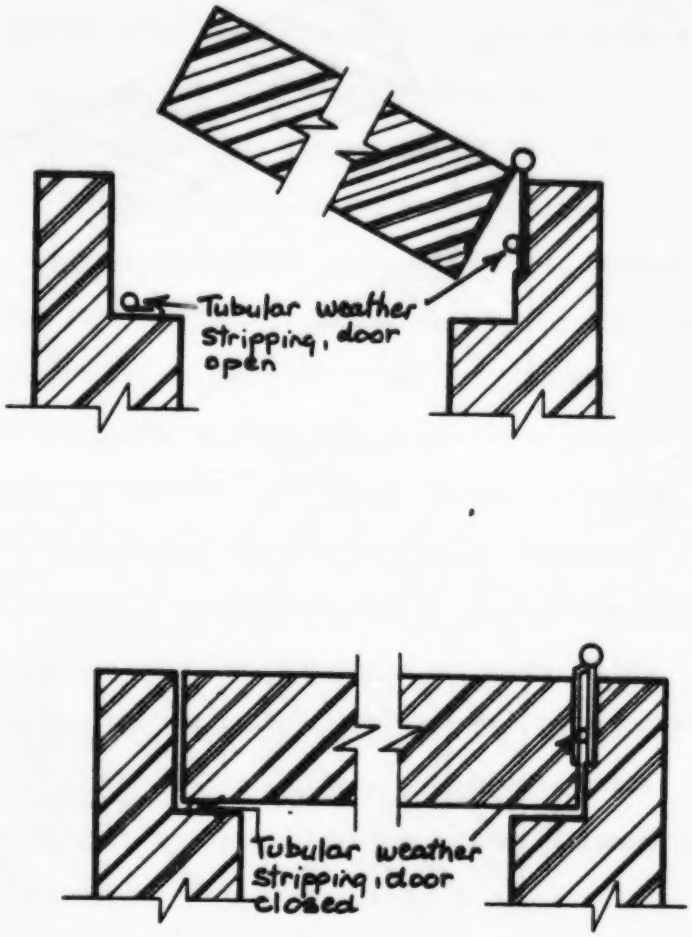


Figure 59 Tubular strips in place with door open, and compressed with door closed.

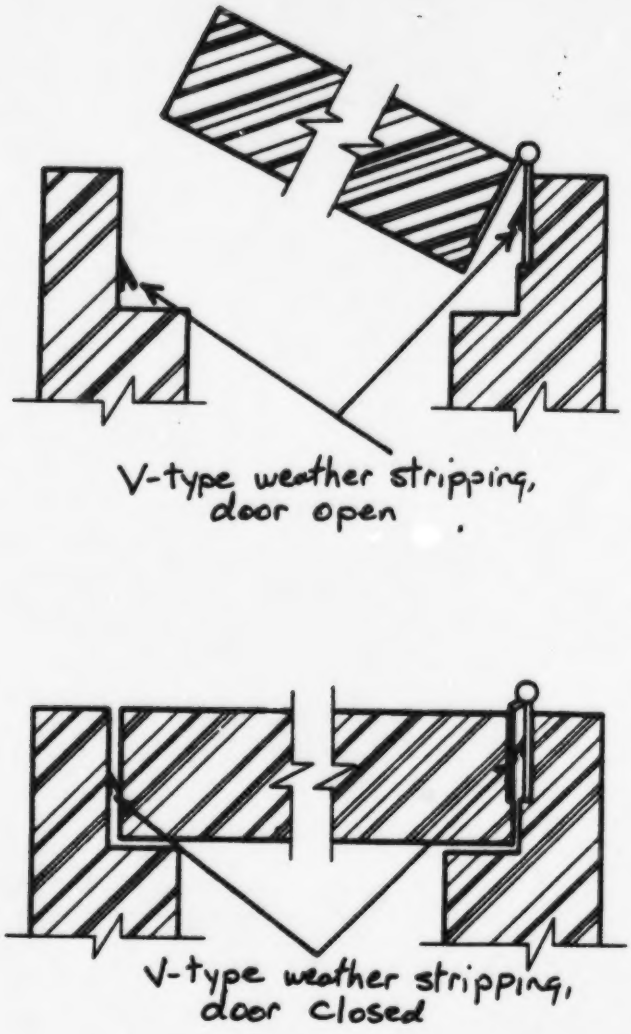


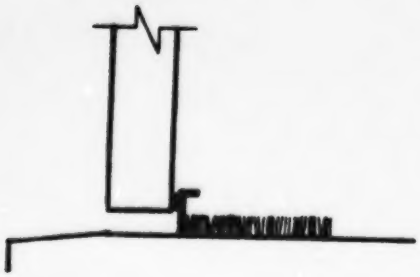
Figure 60 V-strips in place with the door open and closed.

To weather strip the threshold, weather stripping made specially for thresholds should be used. Threshold weather stripping is made larger and sturdier because the bottom of the door does not usually close against a stop. Figure 61 shows a few of the many types of threshold weather stripping.

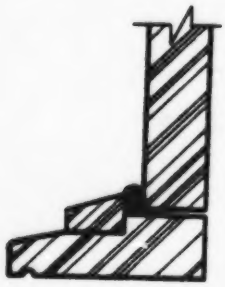
Some weather stripping lasts longer than others. The spring metal strips outlast most adhesive backed weather stripping. The longevity of weather stripping is not, however, its most important characteristic. No weather stripping will be effective against air infiltration if it has not been well mounted. Weather stripping must be tightly fitted at corners to keep the continuity of the seal. Threshold weather stripping must be adjusted to seal when the door is closed. Weather stripping sometimes has to be adjusted because part of the frame assembly moves a little, and the door warps and wears. When using compression weather stripping, it may have to be adjusted to decrease the closing pressure. There are companies which specialize in weather stripping and have the proper equipment to check the effectiveness of their work.

Replacement windows and doors

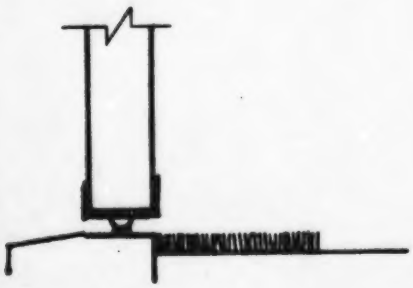
When a lot of repair work is needed to upgrade an existing window or door, it might be more economical to install a new



Sweep types of weather stripping are attached at the bottom and on the inside of an inswinging door. They are made of vinyl, pile or sponge and usually have a metal backing. They drag across the floor overlap the crack when the door is closed. One type of sweep is automatic and retracts when the door opens.



Bumper types of weather stripping are mounted on the threshold on the other side to the direction of the swing of the door. When the door closes, it bumps against the strip and compresses it. This squeezing provides the seal.



Door shoes are placed beneath the door and are drawn over and squeezed to the threshold. Door shoes are framed in metal and have a vinyl insert.

Figure 61

one. The old window or door should be removed a a new one installed. A CMHC evaluation number on a window means that it has been tested to minimum performance requirements of window operation, structural sufficiency, and air and water infiltration. Windows should be double glazed and selected to match the original window style or complement the building style. Windows should also be weather stripped and have good securing latches.

To order replacement windows measure the size of the existing windows opening. Remove the interior trim. If the trim is to be used again, remove it and its nails as was explained under the heading "Upgrading the insulation and reducing air infiltration around the frame".

Measure the existing window frame's outside width and height. Measure the wall thickness. The insulation may have to be removed to insert a measuring tape between the window frame and the wall framing. Measure the size of the rough framing opening. See figure 62. Replacement windows should be 25 to 35 mm (1 to 1½ in.) smaller than the wall framing opening. This space is necessary to square the new window frame correctly and to place insulation. Ensure that the brickmould will be of sufficient width to meet the existing exterior wall finishing material.

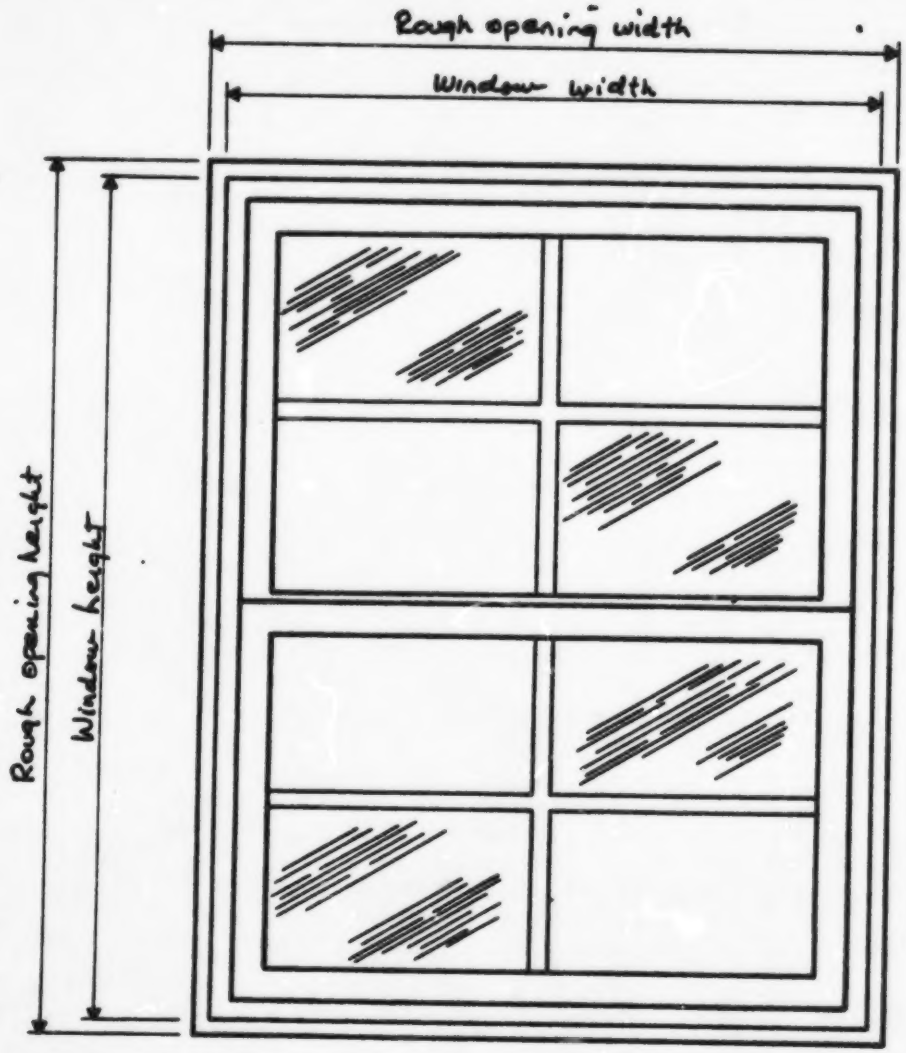


Figure 62 To measure for replacement windows, remove the interior trim and measure the window frame width, height and thickness, and the size of the rough opening.

When new windows are not available in the correct size, custom windows can be ordered or the rough opening filled in to accommodate a smaller standard window size. Nail filler lumber to the sides or bottom or both of the existing rough opening to decrease its size. The interior trim and the brickmould will have to be enlarged.

When removing an existing window assembly, be careful. Any damage done to the interior wall finish must be repaired. See figure 63. Once the old window frame is removed, install the retrofit window following the sequence of steps for a new window.

If window units larger than the existing windows are to be installed, this will require new and stronger window lintels.

Some replacement window units are built to fit inside the existing window frame (figure 64). These windows are usually horizontal or vertical sliding windows and are custom made. One advantage of these replacement windows is that they require little effort to install and little repair work after their installation.

To install such a unit, remove the old sashes. Remove the sash tracks or channels and the window hardware, if necessary for the installation of a particular replacement unit.

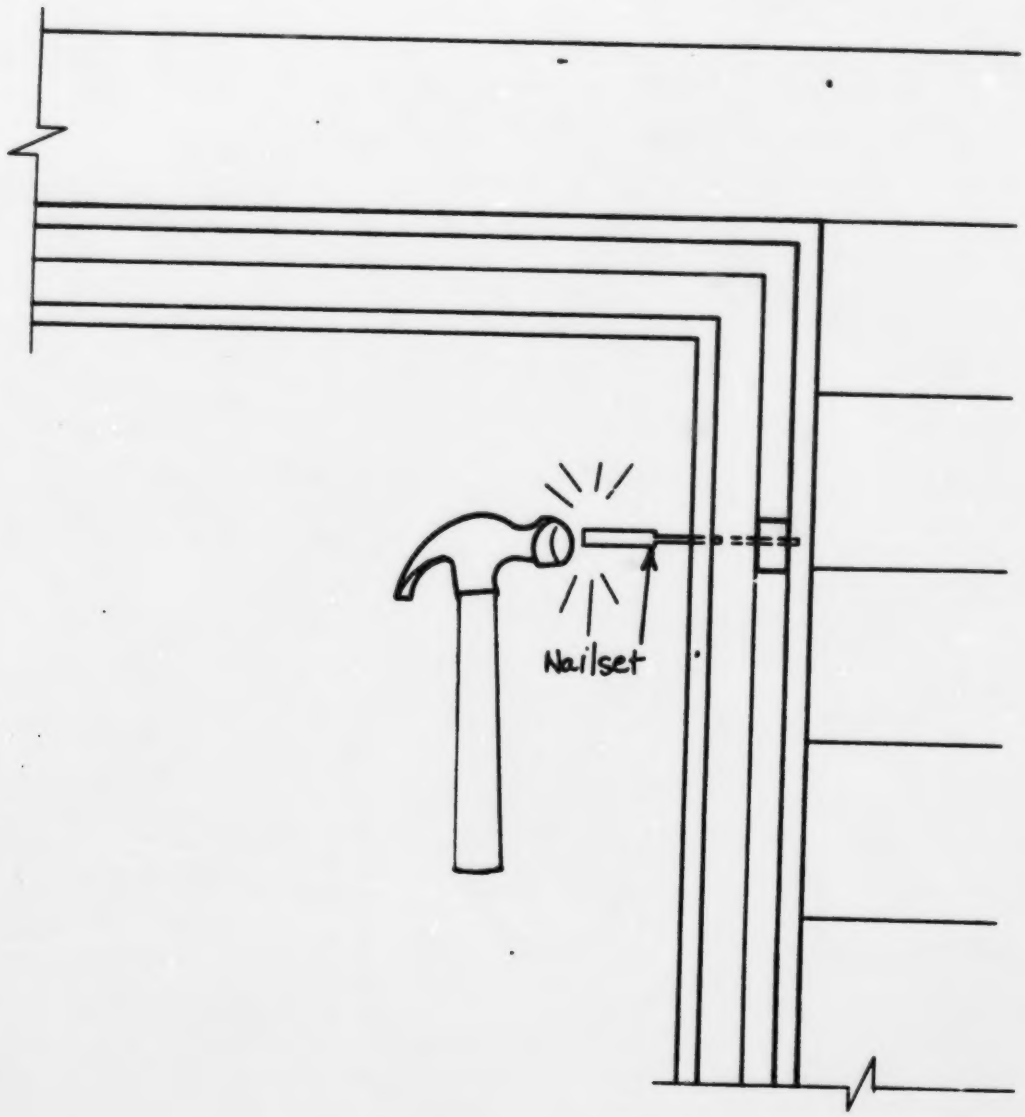


Figure 63 To remove the old window frame, punch nails through the window frame with a nail set or cut them with a reciprocating saw.

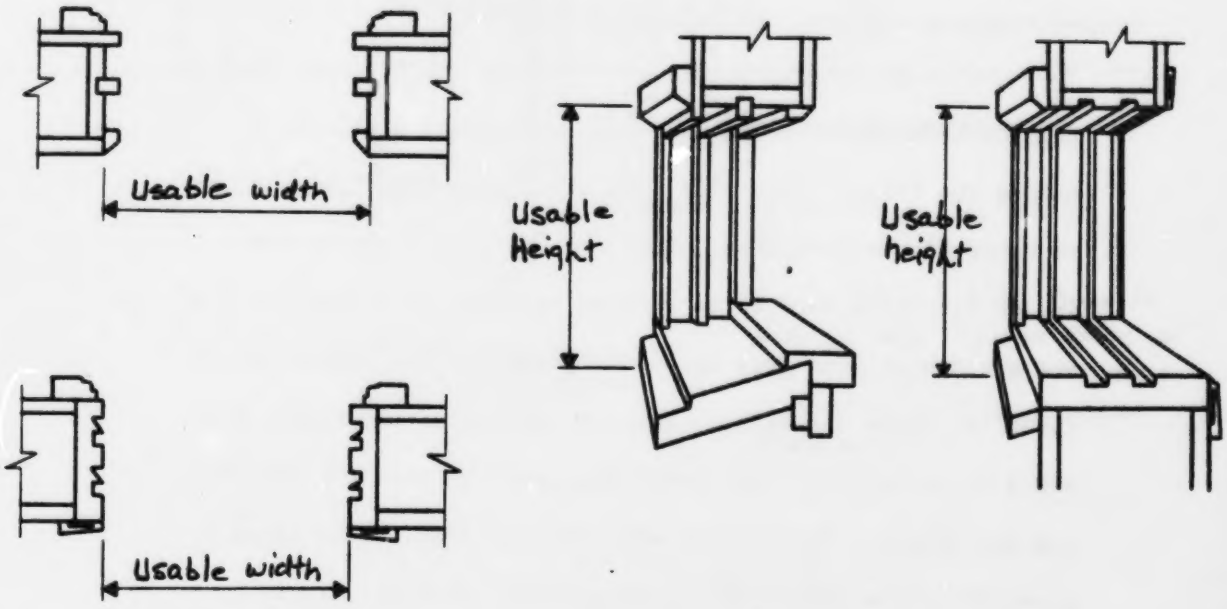


Figure 64 Some window replacement units fit inside the existing window casing and are installed in the same manner as new windows.

Fasten the replacement window inside the old frame just as you would a new window inside a rough framing. When measuring for these replacement units, measure the inside size of the window frame. Deduct 35 mm (1½ in.) from both the height and width. This space will be used for shimming and insulation. Deduct 6 mm (¼ in.) from the existing frame thickness. This will allow the new frame to be set back from the existing frame so that a new second trim can be installed.

The interior trim around the existing window frame must be removed temporarily to upgrade the insulation in the space behind the frame. This trim will probably not be large enough to cover the wider spaces. Rout the existing frame on the inside face (the face to be covered by trim) to a depth of 6 mm and a width of 8 mm from the side facing the new window frame. Cover the space between the new and the routed old frame with new 6 mm thick trim, then cover the space between the new trim and the existing wall finish with the old trim. This gives a pleasant double trim effect (figure 65). Seal all cracks against air infiltration as described earlier.

Replacement Doors

Badly damaged or warped doors may have to be replaced. Replacement doors should match the style of the entrance. A door with a CMHC evaluation number means that the door meets the requirements of CMHC standards.

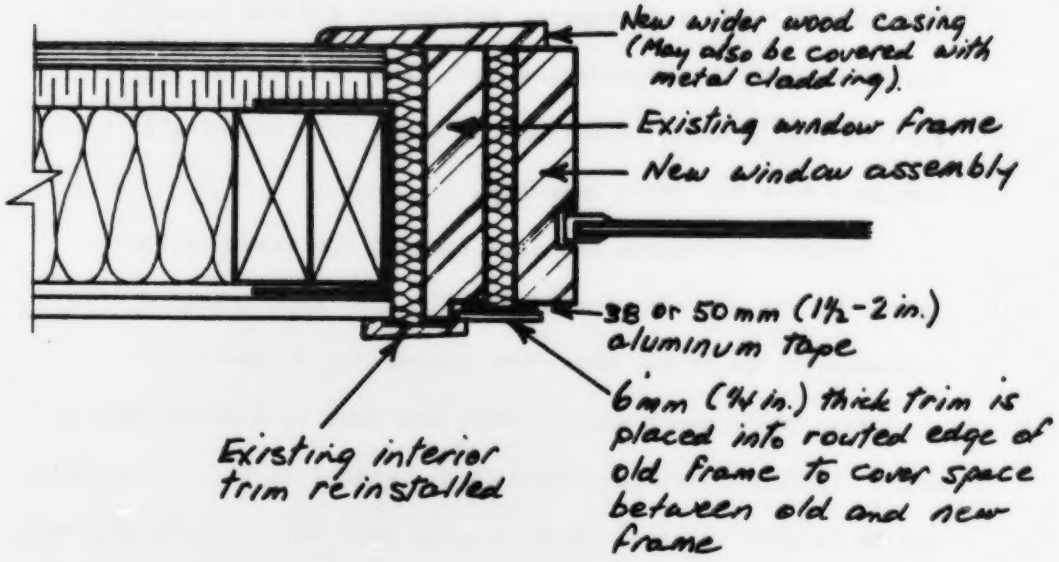

New wider wood casing (May also be covered with metal cladding).
Existing window frame
New window assembly
38 or 50 mm (1½-2 in.) aluminum tape
6 mm (¼ in.) thick trim is placed into routed edge of old frame to cover space between old and new frame
Existing interior trim reinstalled

Figure 65 Double trim covers the space between the new and old window frames.

To order a replacement door, measure the opening height in two places. Measure the opening width at the bottom, centre and top. See figure 66. If measurements differ by more than 12 mm, check the squareness and plumbness of the frame. If badly out of square or plumb, the frame will have to be adjusted. Remove the interior trim and exterior brickmould and cut through all fasteners with a reciprocating saw, then reshim. As an alternative, consider removing the frame and replacing it with a complete door and frame assembly.

Remember to record the direction of the swing of the door. Do not use the size of the old door when ordering a replacement, as it may have been planed out of square.

When replacement wooden doors are hung in a frame that is not a standard size, they have to be trimmed to fit. Some doors can be trimmed up to 12 mm ($\frac{1}{2}$ in.) on each side. Doors may also be custom built to any required size.

Replacement steel doors cannot be trimmed and should, whenever possible, be installed complete with their frame within the existing frame or rough opening. See figure 67. There is a steel door on the market with a special steel adaptor frame designed to fit into an existing door opening. The pre-hung door frame is fastened to the existing door frame.

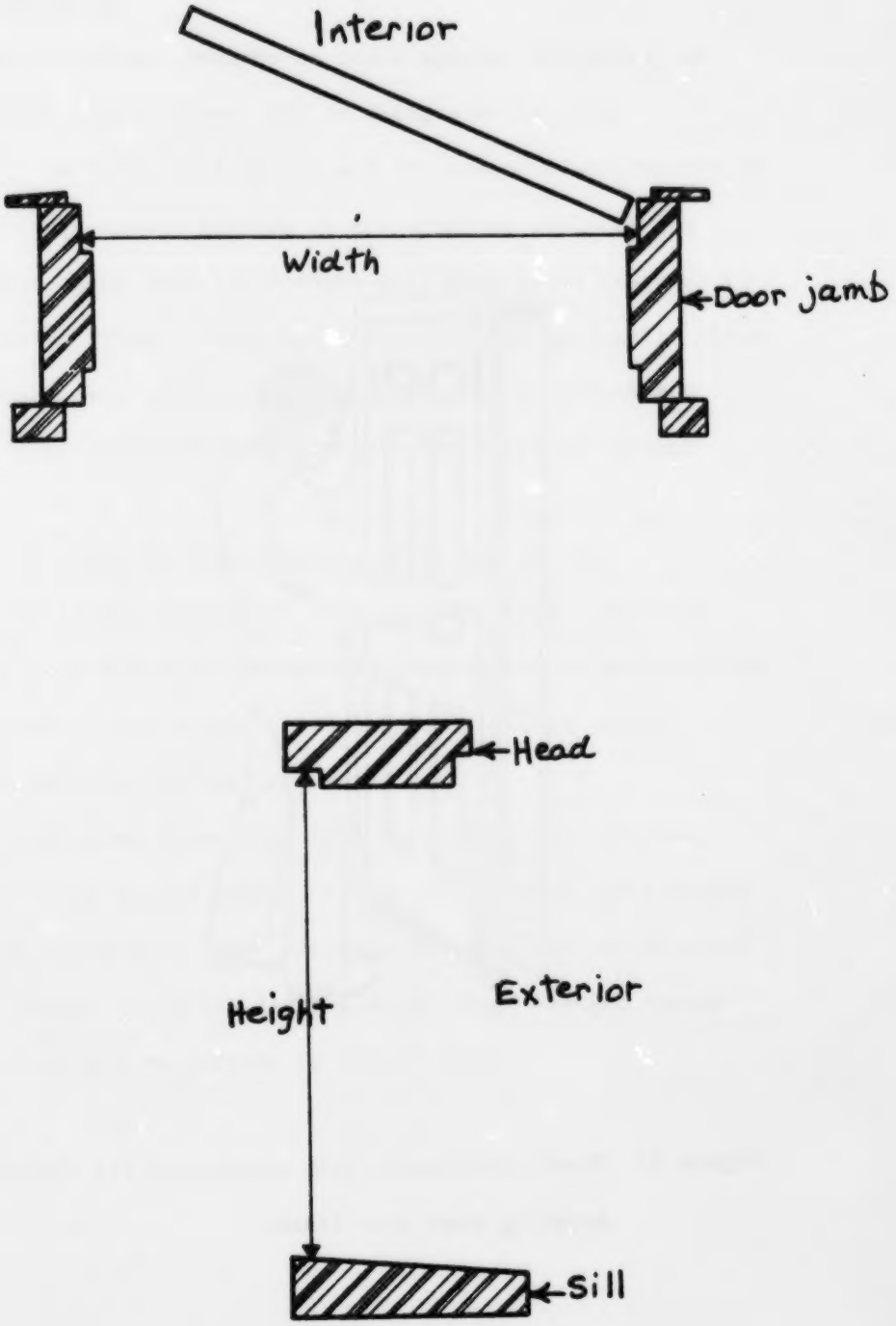


Figure 66 To measure for a replacement door, measure the opening width and height in several places.

Figure 67 Steel replacement door assemblies fit inside the existing wood door frame.

Heritage Buildings

Some older buildings, because of their special historical or architectural significance may be designated heritage buildings. Heritage legislation may dictate that any repairs to these buildings should conform to the original style of the house, which means that the windows will have to be restored to their original design. This makes retrofitting difficult, since older windows were constructed with different materials and toolwork from today's windows and were installed in thicker walls.

Several organizations supply information on the retrofitting of new windows on heritage buildings. Heritage Canada or local associations on the preservation of architecture will give advice and suggest consultants or trades people capable of undertaking heritage work.

When replacing doors that have sidelights and transoms, consider filling in the glassed areas. Sidelights and transoms enhance the appearance of an entrance and maintain its original style and charm, but these large glassed areas are not energy efficient, and are vulnerable to forced entry.

SKYLIGHTS

In residential construction, skylights are installed in roofs to increase lighting levels and add architectural interest to the house. Skylights come in a wide variety of shapes and sizes, as shown in figure 68. They can be single or multiple array and some can be opened. Skylights are constructed from glass, plastics, acrylics, vinyls or fibreglass.

It is good practice to mount skylights on curbs. The curb permits a better sealing at the roof level and simplifies any further resurfacing of the roof. The curb also decreases the amount of snow that can build up over the skylight glazing.

Installation of a skylight on a site manufactured curb

The curb for the installation of a skylight should be constructed of wood at least 38 x 89 mm (2 x 4 in.) toenailed to the roof framing by 87 mm (3½ in.) nails (figure 69). If the roof or ceiling opening is greater than two rafter or ceiling joist spacings then the framing members must be double on each side of the opening.

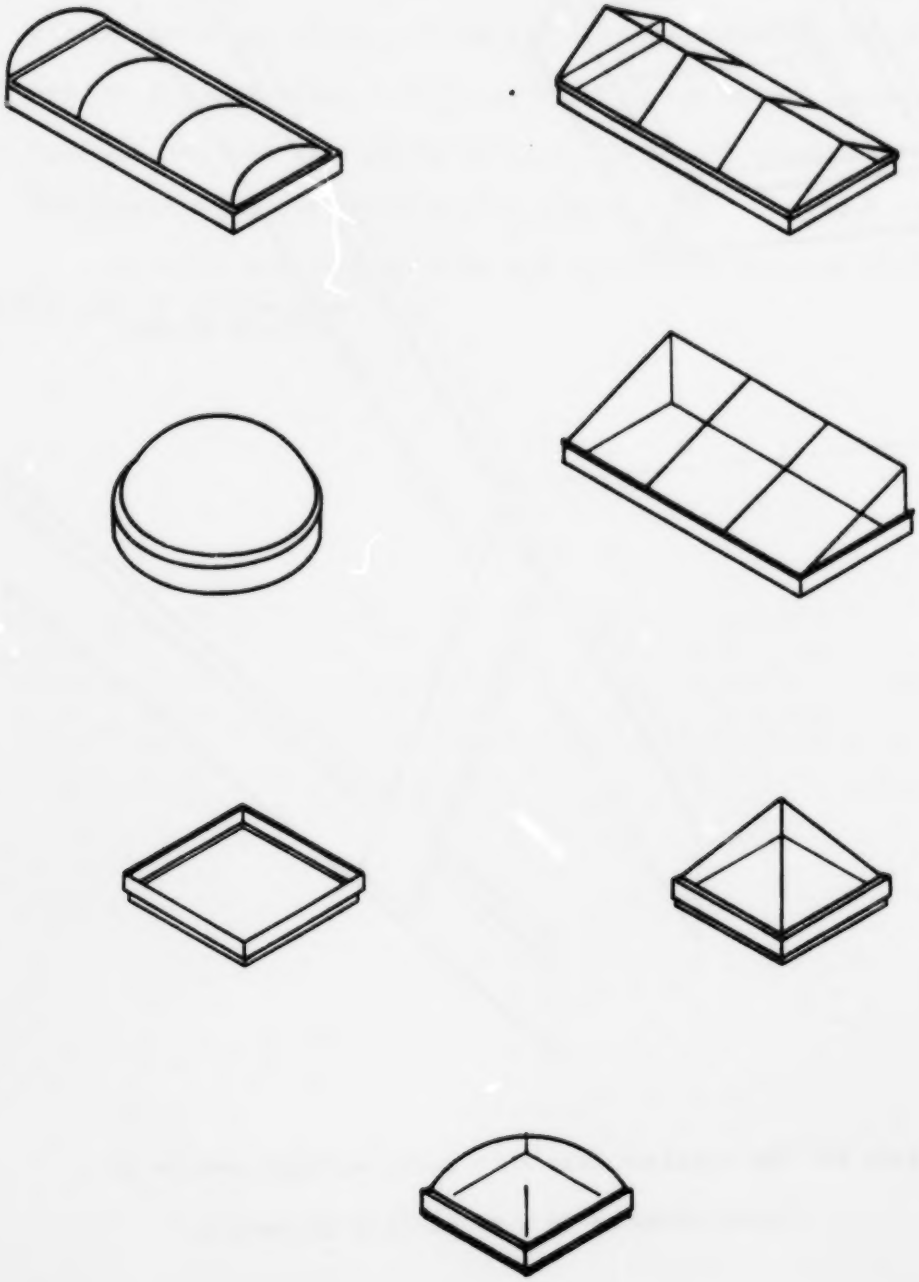


Figure 68 A variety of skylights.

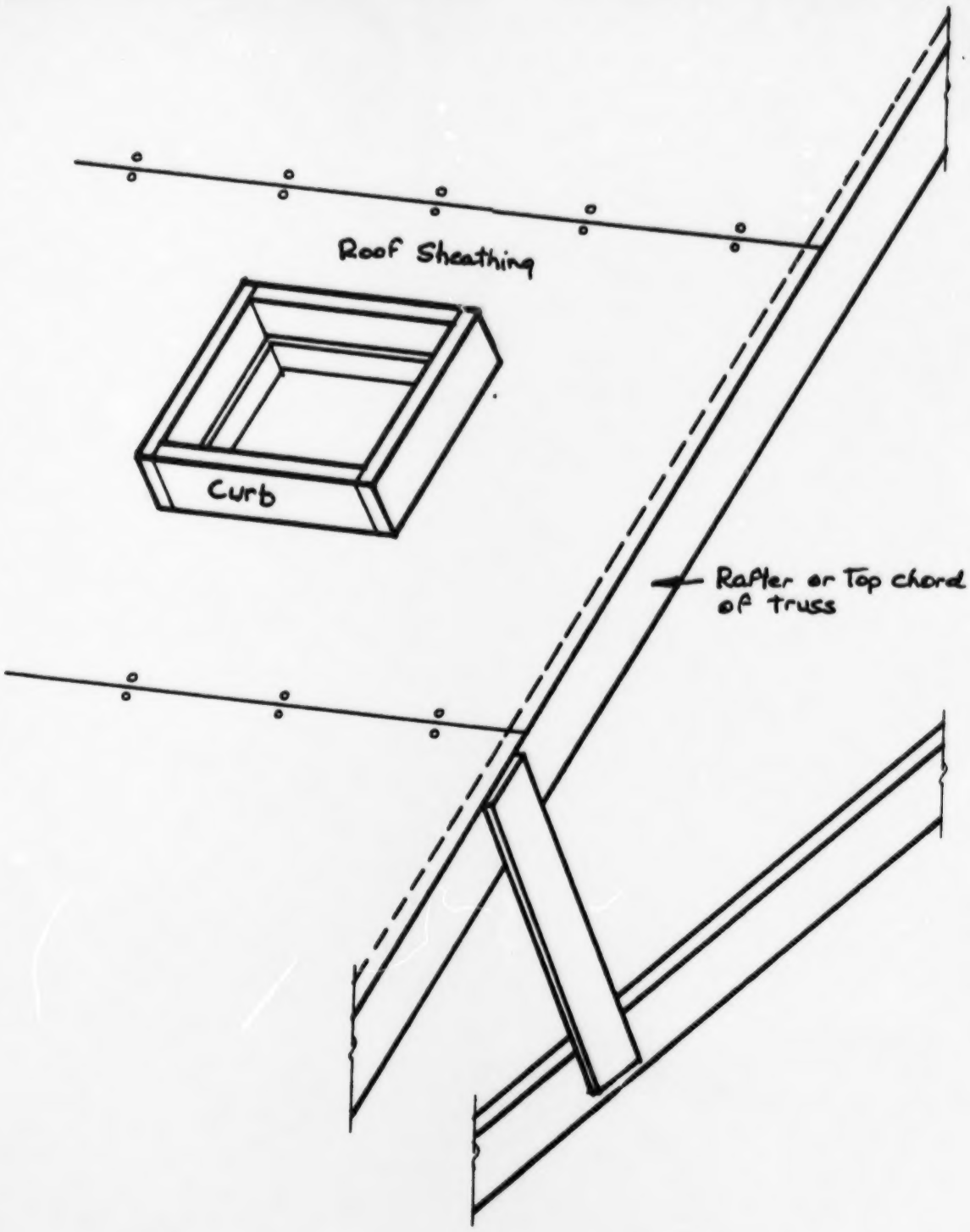


Figure 69 The smallest size curb for a skylight should be constructed of 38 x 89 mm (2 x 4) lumber.

The exterior portion of the curb should be insulated with 25 mm (1 in.) minimum rigid board insulation.

The skylight should also be flashed to the curb. Flashing should extend a minimum of 75 mm (3 in.) over the roof surface and, up the roof slope, a distance equal to the height of the curb but not less than 150 mm (6 in.). Caulk all around between the skylight and the mounting curb (figure 70).

Skylights that are operable for ventilation purposes should be able to be locked.

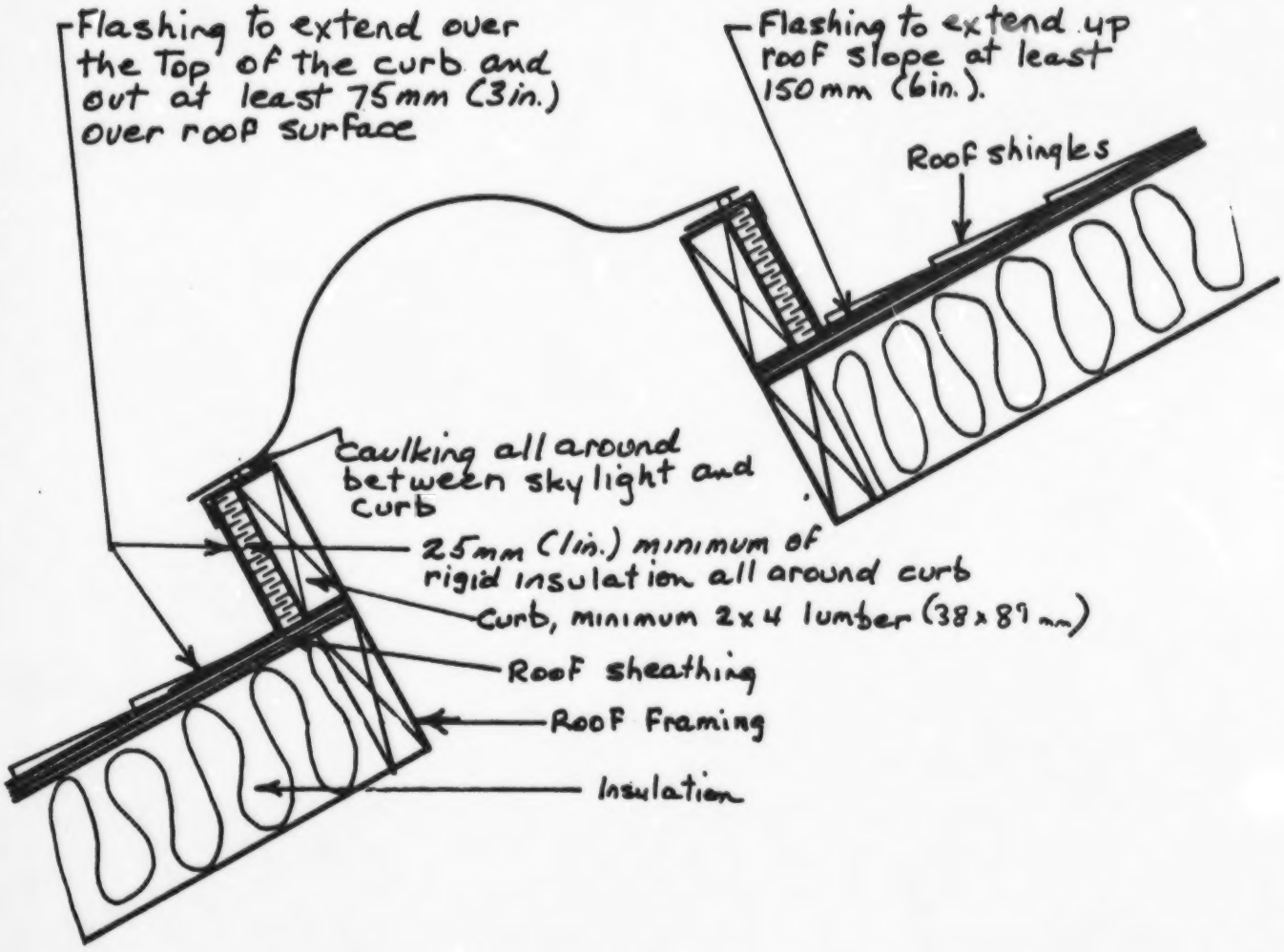

Flashing to extend over the Top of the curb and out at least 75mm (3in.) over roof surface
Flashing to extend up roof slope at least 150mm (6in.).
Roof shingles
Caulking all around between skylight and curb
25mm (1in.) minimum of rigid insulation all around curb
Curb, minimum 2x4 lumber (38x89 mm)
Roof sheathing
Roof Framing
Insulation

Figure 70 The mounting curb should be insulated and flashed and the crack between it and the skylight caulked.

HARDWARE

Any security provided by a door assembly is useless if the door's its hardware is inferior. Similarly, while the glass in a window may be broken, if its keyed lock still secures the sash and prevents it from being opened, entry may be discouraged. Doors and windows, while they must be well secured, should unlock and open quickly in case of fire.

Door hardware

New wood doors are usually purchased without any locking hardware. Metal doors come with hinges and pre-drilled holes for locks. Install the horizontal or vertical deadbolt types. Locks may sometimes be supplied which are not of a deadbolt plunger type. Consider adding or changing to a deadbolt type, either horizontal or vertical. See Securing Doors and Windows against Forced Entry for illustrations of deadbolt locks. Vertical deadbolt locks (also known as jimmy-proof locks) have plunger throws that become rigid when locked. They are difficult to pry open and do not release when the outside knob is forced or broken.

A standard lock strike plate is the weakest point in a door assembly. When the door is subjected to force, the strike plate screws are ripped from the door jamb and the door opens. Replace standard strike plates with higher security strike

plates or strike boxes. These accommodate more screws than the others. Use screws longer than those stipulated so that they penetrate the wall framing studs. See figure 71.

Doors should be hung with at least three 90 x 90 mm (3½ x 3½ in.) solid butt hinges at least 25 mm (1 in.) thick. Entrance doors under 2.3 m (7ft. 6 in.) high require three hinges. Doors higher than this require additional hinges. To select the proper hinges for an entrance door, consider the door's weight, the trim clearance (this may limit the hinge's width) and whether the door takes a right or left hand hinge. See figure 72.

Window hardware

Every openable window should be equipped with corrosion-resistant locking devices controlled from the interior, but the window locking devices supplied with new windows usually offer little resistance. Additional locks should be added to windows located in hidden areas and on all lower level windows, and to doors and sliding patio doors.

Key operated locks can be placed on metal or wood windows. These locks provide a bolt which, when secured, cannot be unlocked except by turning the key. See Securing Doors and Windows Against Forced Entry.

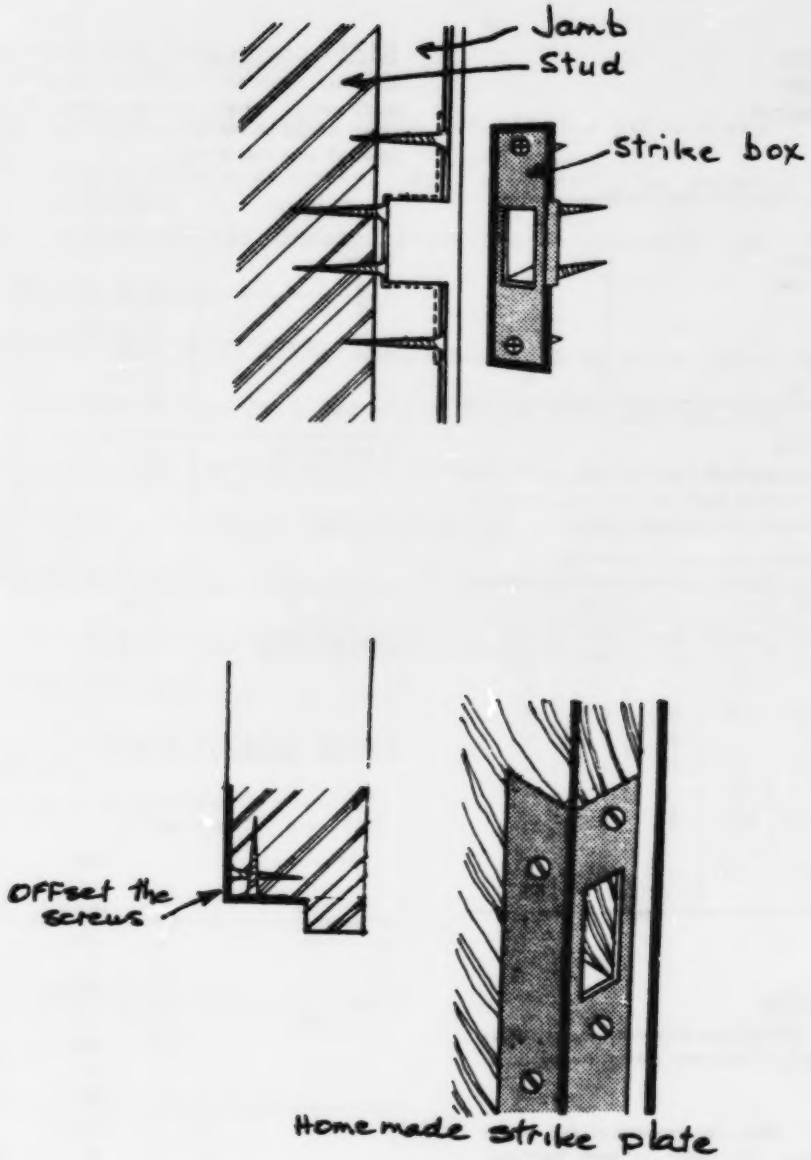


Figure 71 High security strike plates accommodate more screws and resist better against a forcible entry.

HOW TO SELECT THE PROPER HINGE

NUMBER *OF HINGES PER DOOR OR TRANSOM*

	Number of Hinges
Door	
60 inches high and under	2
Over 60 inches to 90 inches	3
Over 90 inches to 120 inches	4
Transoms	
48 inches wide and under	2
Over 48 inches to 84 inches	3

WEIGHT *OF DOORS*

The table shows approximate weight of doors. In cases where door weight is considered heavy, or where doors will have high frequency use, *extra heavy ball bearing hinges* should be specified.

Approximate Door Weight—pounds per square foot

Door Thickness	1⅜"	1¾"	2"	2¼"	2½"
Ash	4½	5¼	6	6¾	7½
Birch	3¾	4⅓	5	5⅔	6¼
Fir	3	3½	4	4½	5
Mahogany	4½	5¼	6	6¾	7½
Oak	6	7	8	9	10
White Pine	3	3½	4	4½	5
Hollow Core	2	2½	–	–	–
Solid Core	3½	4½	5	5½	–
Kalamein	–	5	–	–	–
Hollow Metal	6½	6½	6½	6½	6½
Tubular Steel	–	5	–	–	–

FREQUENCY GUIDE

In general, the following facts will help you determine whether doors you are specifying for will have high frequency, average frequency, or infrequent use:

HIGH FREQUENCY—entrance doors on commercial and public buildings and interior doors to toilets in such buildings. *(Ball-bearing hinges should be specified for these and for doors equipped with door closers.)*

AVERAGE FREQUENCY—interior doors to office building corridors, store toilets, and exterior doors of homes.

INFREQUENT SERVICE—interior doors in homes.

SIZE *FOR DOORS AND TRANSOMS*

Door sizes given are jamb opening dimensions. Hinges are regular weight except where indicated "heavy weight." However, heavy weight hinges should be specified where high frequency service is expected, even though regular weight is shown in table.

Thickness (inches)	Door width; transom height (inches)	Hinge height (inches)
Doors:		
1⅛	to 36	3
1⅜	to 32	3½
	33 and over	4
1¾	to 36	4½
	37 to 48	5 Heavy Wt.
	49 and over	6 Heavy Wt.
2, 2¼ and 2½	to 42	5 Heavy Wt.
	43 to 50	6 Heavy Wt.
Transoms:		
1⅜	to 20	2½
	21 to 36	3
1¾	to 20	3
	21 to 36	3½
2, 2¼ and 2½	to 20	3½
	21 to 36	4

TRIM CLEARANCE *FOR WOOD OR HOLLOW METAL DOORS*

Clearance is estimated on hinges set back ¼" for doors up to 2¼", and ⅜" for doors 2½" to 3" in thickness

Thickness of Door	Width of Hinge	Maximum Clearance Provided
1⅜"	3½"	1¼"
	4"	1¾"
	4½"	2¼"
1¾"	4"	1"
	4½"	1½"
	5"	2"
	6"	3"
2"	4½"	1"
	5"	1½"
	6"	2½"
2¼"	5"	1"
	6"	2"
2½"	5"	¾"
	6"	1¾"
	8"	3¾"

The hinge WIDTH of Half Mortise, Half Surface, and Full Surface Hinges is standard, depending on the hinge LENGTH. Note that in these hinge types, the amount of hinge clearance available is determined by the amount of offset and not by the hinge width.

Figure 72 Tables prepared by the Hager Hinge Co as a guide in selecting the proper hinge.

Sliding patio door hardware

Because of space limitations, locks for sliding patio doors usually provide little security. They may easily be pried opened. Additional key operated locks can be placed on the tracks of the doors.

Another type of securing device for sliding patio doors is a fold down bar. This is a bar which folds down against the sliding patio door and prevents it from being opened. See the section Securing Doors and Windows Against Forced Entry.

For more detailed information on hardware refer to CMHC's publication Protecting Your Home Against Burglary, NHA 5394.